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HERBERT ALONZO HOWE.

By DINSMORE ALTER.

Perhaps this short biography may best be begun by quoting, as did the Chancellor of the University of Denver during the memorial service for Dr. Howe, a remark made by its first chancellor in 1880: "There goes the purest hearted and cleanest lived young man I have ever known." Those of us who have been his pupils from time to time during the almost fifty years of service which he gave to the University will all echo the statement.

Herbert Alonzo Howe was born at Brookport, New York, November 22, 1858. He graduated from the University of Chicago when sixteen, and took his master's degree at eighteen under Professor Ormond Stone at the University of Cincinnati. In 1884 he received the Sc. D. from Boston, and in recent years the LL.D. from two other schools.

During the five years in which he was assistant and student at Cincinnati, close application to his work broke his health. He told the writer once of staggering, like a drunken man, from fatigue when leaving the observatory after a long winter's night of continuous measurements of double stars. Twenty years leaves a slight uncertainty concerning the number measured on that occasion, but it is remembered as one hundred and twenty-six. Two severe hemorrhages from the lungs, early in 1880, warned him that a change was necessary both in climate and habits if he was to live.

Chancellor (later bishop) David H. Moore was forming the first faculty of the University of Denver and offered him the professorship of mathematics and astronomy. In Denver his health immediately improved, but it was felt unwise to accept positions elsewhere, despite the fact that his career as an astronomer was suffering from lack of facilities and time.

About 1890 it seemed once more that his desire to devote his life to astronomical research was to be fully realized. He secured from Mr. Humphrey B. Chamberlin the gift of an excellently equipped observatory for the University. The principal instrument was a twenty-inch refractor with Clark lens and Saegmuller mounting. All who have worked with this instrument will attest its excellence in every way. Doctor Howe recognized the part which photography was to play in future astronomy, and an attempt was made to adapt this refractor to

such work as well as visual, by so computing the crown lens that its reversal gave an instrument in which the violet light was brought to the flattest focus.

Mr. Chamberlin also promised an endowment through which Doctor Howe could devote all his time to the observatory and secure such assistance as might be needed. However, the panic of 1893 ruined him financially and he died later, just as he was becoming able once more to fulfill the promise.

By this narrow margin did the observatory and Doctor Howe miss a much more brilliant scientific opportunity. The University was small and poor. Doctor Howe had a versatility which enabled him to substitute in almost any capacity; as a teacher his subjects ranged at times from Greek to science and as an administrator both as dean and as acting chancellor. At one time or another during those early days he taught nearly every subject in the curriculum. His conscientiousness and his ability to perform them satisfactorily brought him every possible sort of task. Refusal to perform them might have permitted more astronomical work to be done, but possibly the corresponding loss to the University would have balanced this scientific gain. From 1892 till last spring he was dean of the college, and before the election of Henry Augustus Buchtel as Chancellor he was acting chancellor. For years he taught advanced courses in mathematics and in mathematical physics in addition to those in astronomy. At no time was an observatory or teaching assistant provided for him.

Despite these handicaps to his career and to the observatory he managed to perform considerable research, something which few others would have attempted under the circumstances. Double star measurements and the positions of nebulae were his chief program. The freedom of his work from errors was almost proverbial. Kepler's problem, whose solution becomes long and involved when the eccentricity is large, intrigued him and his solutions have shortened the task. He wrote an excellent textbook, now out of print, on elementary astronomy, and a more popular book, which had a wide distribution, entitled, "A Study of the Sky."

In September, 1922, his health broke suddenly. He was given a year's leave of absence, his first, from the University and spent it in Southern California. He returned to his duties. Last spring he was made Dean Emeritus, though still continuing actively at the observatory. He died on the second of November. The tributes paid him showed the love which his half century of service to Denver had engendered in its citizens.

In 1884 he married Miss Fannie Shattuck who survives him. He leaves also four sons.

Doctor Howe is the type of man of whom one is able to say with pride: "He was my teacher."

RECENT TEXTBOOKS AND RELATIVITY.

By J. G. PORTER.

I have examined several modern textbooks on astronomy, in each of which relativity is treated as a theory practically proved. This, in the opinion of many, is so far from being the case, that it seems to me a vigorous protest is called for.

Everyone familiar with the work of Leverrier and Newcomb knows that the motion of Mercury's perihelion, so exploited by the relativitists, is only one of several discrepancies found among the planetary motions. Most of these discordances, so far from being explained by the Einstein theory, are either untouched or rendered worse. Even the advance of Mercury's perihelion can not be satisfactorily explained by relativity. It is absolutely certain that the sun, being a rotating body, is not spherical. Using the smallest possible value for the oblateness, the unexplained motion of Mercury's perihelion is reduced to about 36″ per century against 43″ which Einstein claims his theory would cause. This is too great a difference to be ignored by astronomy. It shows that relativity fails utterly to account for the one deviation which Einstein selects to prove his theory. On the other hand it is possible to account satisfactorily for all the differences by the old gravitational methods; so that, as Professor Poor well says in his book, "Gravitation *versus* Relativity," "The Einstein hypotheses and formulas are neither necessary nor sufficient to explain the discordances in the planetary motions."

The other astronomical proof offered by the relativitists, namely the bending of the rays of light as shown on the eclipse plates, is equally fallacious. The results of the 1919 eclipse have been thoroughly discussed by Professor Poor in his book. The extreme weakness of the results is there well brought out. I would, however, call especial attention to the radical disagreement in direction between the observed and predicted displacements.

Coming now to the Lick Observatory observations of the eclipse of 1922, published in *Lick Observatory Bulletin*, No. 346, the same discordant results are found. For instance, taking five classes of stars according to their theoretical radial displacement, we have:

Theoretical displacement	No. of stars	Average % of error
Over 0″.50	8	56
0″.50 to 0″.40	4	92
0″.40 to 0″.30	7	45
0″.30 to 0″.20	10	74
0″.20 to 0″.10	26	137

Taking these 55 stars together we find the per cent of error 97; that is to say, the observed radial components as corrected in Table II differ

on the average from the theoretical values by practically the whole amount of these values. I hardly think that astronomers will be willing to accept a revolutionary theory on such discordant data.

Furthermore, a glance at the diagram on page 48 shows that the deviations of the stars, so far from being uniformly radial, or nearly so, take place at all sorts of angles. The deviations of less than one-sixth of the stars are anywhere near radial.

There are certainly two causes for the displacements of the stars on the eclipse plates, aside from the Einstein explanation. The first of these is the refraction by the solar atmosphere. That such refraction exists is certain, be it little or much. To claim the whole of the deviation for the Einstein theory is unreasonable. Another cause for the displacement of the stars is to be found in the abnormal refraction in the earth's atmosphere. How anyone could expect under the circumstances to obtain satisfactory measures of deviations amounting in nearly all cases to only a fraction of a second, is beyond my comprehension. For we have here a comparison of plates taken under normal conditions with those taken under the worst possible conditions. The rays of light from the stars must pass into the shadow cone of cooler air, along the border of which very disturbed conditions must prevail. Here we shall surely have abnormal refraction, aside from a certain amount of radial refraction. That the refraction at the sun, combined with the refraction in the earth's atmosphere will best account for the irregular deviation actually observed, is the opinion of many who have examined the subject. Here again relativity both fails to explain the observed facts, and is besides totally unnecessary.

The last proof relied on by the relativitists is the shifting of the spectral lines towards the red, especially in the case of the companion of Sirius. It is passing strange that the only star among the millions in the sky which has been found to be in this most remarkable state of condensation necessary for Einstein's vindication, should be one lying so close to the mighty Dog-star as to render observation extremely difficult, if not inconclusive. Most astronomers will prefer to wait for further evidence before accepting this seeming anomaly. In the mean time why is it that our authors seize avidly on this plausible proof, while failing entirely even to mention Professor Miller's discovery of an ether drift, which, if corroborated, will go far towards disproving the Einstein theory?

There are many results of the theory of relativity which to the normal mind are opposed to common sense, and therefore unthinkable. Unless the theory can be proved beyond the possibility of a doubt, it seems to me it should have no place in textbooks of astronomy. That it is yet far from being so proved I take to be incontrovertible.

Cincinnati Observatory.

REPORT ON MARS, NO. 39.

By WILLIAM H. PICKERING.

Seasonal Changes of Detail.

We have now reached that point in our knowledge of Mars, where we feel it safe to predict those apparitions during which rapid surface changes are likely to occur. Thus in 1924 we ventured to state that striking changes would probably take place upon the planet in 1926, and in our Report No. **36** illustrated what some of these changes would be like. Although other changes will without doubt be recorded at the next apparition, few as marked as these, and as wide spread, are likely to occur again before 1937. It must be understood that these predictions were based solely on what we had seen occur at previous apparitions, at a certain time in the Martian year, namely the winter season of its northern hemisphere. I had never seen the planet near at hand at this season, and my views of the details of its surface were therefore somewhat indistinct. Moreover the question arose in my mind, was it not possible that the changes observed were a mere illusion, caused by the remoteness of the planet? I felt sufficiently sure of my drawings, however, to venture the prediction, but was naturally very anxious to see how it would turn out, and how the planet would look near at hand when these changes were actually taking place upon its surface. It must be understood, as was pointed out in Report No. **36**, that while we can now predict the approximate time at which these changes will take place, and their approximate character, it is quite impossible, since they are due mainly to the formation of or the precipitation from Martian clouds, to foretell their exact shapes, or the exact dates at which they will occur. During this last apparition a change moreover took place in the Thaumasia region, whose character we only partially expected, since it had never previously been recorded, and which we shall deal with presently. First, however, we will look at some of the more fully expected changes.

On Plate VII the first two columns of figures are reprinted from Report No. **36**. The first column gives the usual appearance of these regions, and the second shows the changes that they incurred in the years 1913, 1924, and 1925. The figures in the third column were all drawn at this last apparition, and show similar changes occurring at about the same season of the year. Under each figure is given the date on which the drawing was made, followed by the longitude ω of its central meridian. Below that is given the solar longitude $\odot$, and the corresponding Martian date. Supplementary data are given in Table I, where the first two columns give the number of the figure, and the number given to it in Report No. **36**. Next follow the latitude of the center of the disk, its diameter, and the quality of the seeing. The last

two columns give the difference in the solar longitude of the two figures that resemble one another, and the corresponding difference between the Martian date in 1926 and that in the earlier years expressed in Martian days. The plus sign indicates that the expected change in 1926 came later in the Martian year than the change observed in the earlier years.

Turning now to the drawings themselves, Figure 1 shows the Syrtis, or Syrtis major as Schiaparelli called it, to the right or west of the central meridian, and the Syrtis minor, greatly enlarged as it appeared at one time in 1924, on the right. The bright region between them, just north or below the center of the disk is known as Libya, and was early recognized by Perrotin as a region which sometimes turned dark (Reports Nos. **27**, 12, **25**, Figures 21, 22, and 24, and **29**, Figure 23). Figure 2 is drawn with the central meridian in longitude 294°, or differing by 24° from that of Figure 1. In consequence the Syrtis is now brought to a position just below the center of the disk. As a result of the recent melting of the southern snow cap, a yellowish cloud is seen in the place of the latter, and other clouds cover a large part of the southern hemisphere. Still farther north another cloud partly covers a portion of the Syrtis itself, leaving the tip, however, faintly visible. Libya has obviously darkened, while the Syrtis minor has disappeared.

It was reasonable to expect, based on our previous knowledge, that this change would occur again in 1926. Indeed it occurred twice, on August 19, and again on December 4, with Libya bright for most of the time between the two. The drawing of the earlier date is given in Figure 3, which has approximately the same central meridian as Figure 1, and not a very different latitude, as we see by Table I. It will be noticed by the last column of the Table that in 1926 the change occurred 82 Martian days earlier than it did in 1924. On the other hand the second darkening in December occurred 23 Martian days later than in 1924. We thus see how hopeless it is to attempt to predict accurate dates for the appearances of the Martian changes.

TABLE I.

CHANGES EXPECTED IN 1924 TO OCCUR IN 1926.

Fig.	**36**	Lat.	Diam.	Seeing	$\Delta\odot$	Days
1	3	—20°	16″.3	10		
2	20	—25	8.7	7		
3	..	—15	13.2	6	—50°.4	—82
4	13	—18	18.7	10		
5	16	+ 3	7.8	8		
6	..	—13	15.9	10	—39.2	—65
7	14	—25	9.5	6.7		
8	..	—20	17.4	5	+14.1	+25
9	9	—22	13.2	7		
10	11	—24	7.1	8.7		
11	..	—20	17.4	5	— 6.5	—10
12	21	—23	12.9	8		
13	22	—25	8.9	8		
14	..	—20	16.6	8	+12.3	+22

The next change was due to an unusually strong development of certain canals, caused obviously by the transfer of the moisture across the planet's surface. This was combined with a very thick haze in the dense Martian atmosphere. Our first drawing, Figure 4, was made before this occurred, and the planetary details are clearly seen. Sabaeus with the Furca is shown on the left of the disk, Margaritifer with the little Oxia below it on the central meridian, and the broad gulf of Aurorae on the right. The drawing Figure 5, based on which the change was predicted, was not made in 1924, however, but in 1913. Owing chiefly to the difference in phase between the two drawings, as shown by the short lines marking their poles, Aurorae is here brought nearer to the center of the disk, and Ganges, Jamuna, Nilokeras, and Chrysorrhoas form broad bands faintly seen through the mist. In Figure 6, drawn at the past apparition, Aurorae is located well to the right of the central meridian as in Figure 4, and Ganges descends from it to a large darkened area which is really Lunae, but is here extended unusually far towards the right, enveloping Chrysorrhoas. An unusual canal, Lowell's Phryxus, stretches out to the left. To the right of Aurorae is a darkened area extending over Thaumasia, which we shall later more fully describe.

The next change to which we shall refer occurred two months later in this same area, which, as mentioned in previous Reports, is noted for its changes. We need not therefore repeat Figure 4, but will refer Figures 7 and 8 to it. In both of these figures Aurorae is seen well to the right of the central meridian, with Ganges descending from it as a broad band towards the northwest. About as far to the right of the central meridian, and in both cases rather farther to the north, we recognize the Furca, although its two bays cannot now be separated. It is comparatively faint, and the difference of these drawings from Figure 4 is rather strongly marked. Both the later drawings show a pair of southern canals extending up towards the polar cap, as well as some broad northern canals not seen in Figure 4, which is freer of haze, and is more clearly defined. Dealing still with this same general region, but in a slightly higher longitude, we have in Figure 9 Aurorae just below the center of the disk, and the dark Solis to the right and above it, the two being joined by the narrow Nectar. In Figures 10 and 11, in practically the same latitude and longitude as Figure 9, the whole disk is dimmed by Martian haze, but Nectar and Solis are much larger, while Ganges in the three drawings shows three different states of development. The darkening to the right of Aurorae, mentioned in connection with Figure 6, shows again, but is somewhat narrower than in the earlier drawing.

In Figure 12 we find Sabaeus well marked and just below the center of the disk. In Figure 13 with practically the same central meridian it has nearly or quite faded out, while Deucalionis, the bright region to the south of it, has darkened as far south as Pandorae. Figure 14 shows an intermediate development in these respects. Much farther south in

the last two figures we see a conspicuous lake at the intersection of four canals, which replaces a much larger dark area visible in Figure 12. The northern left hand of these canals is evidently Hellespontus, shown as a very dark rounded canal in Figure 12, and as two or three times as wide in previous apparitions. The right hand northern canal in Figure 13 must be its continuation, but very much narrowed as compared with Figure 12, while the two canals of Figures 13 and 14 flowing towards the southeast are probably identical. In a drawing made on July 9, 1926, ⊙ 241°.0, the lake and the two southern canals of Figure 13 are clearly shown, as well as the canal leading northerly from the lake, shown in Figure 14, thus confirming both drawings where they differ from one another. Another drawing made August 12, ⊙ 262°.4, also confirms the northern canal in Figure 14.

Gehon is one of the best known of all the canals, and in all the drawings of Reports Nos. **34** and **35** leaves the Furca in a northerly direction. The corresponding canals in Figures 13 and 14 therefore are either not identical with Gehon, or else show a notable shift towards the west in their orientation. This orientation is corroborated by Figure 23 of Report No. **36**, drawn at another presentation. In somewhat earlier drawings in both 1924 and 1926 Gehon is invisible, while in still earlier ones it leaves the Furca, as we have above noted, in a northerly direction. This latter agrees with the Antoniadi map of Report No. **15**, while Lowell agrees with neither, but draws Gehon with an intermediate direction. He indicates, however, a faint nameless double canal travelling due north. In the writer's map of Report No. **36**, based on the five apparitions of 1914 to 1922, one canal only is shown travelling due north. It would appear therefore that two canals, one nameless, are involved. Each at different times, when it only was visible, has been called Gehon. It may be noted incidentally that Schiaparelli inclines Gehon slightly to the *east* of north.

On comparing the diameters of the similar drawings shown in the last two columns of the plate, by means of the fourth column of Table I, we see that in the last year the apparent size of the planet was larger by from 1.5 to nearly 2.5 times. The resemblances nevertheless are fairly close, in spite of the smaller diameters when the earlier drawings were made. Neither was there very much more detail shown in the later drawings, although this last was possibly in part due to the difference in the instruments employed. We therefore conclude that these marked changes in the planet's appearance during its cloudy seasons, in the earlier drawings were due, not to errors caused by its small apparent diameter, which in none of these cases exceeded 9″.5, but were genuine changes occurring upon its surface. And we further conclude, from a study of the Table, that we should not neglect to study the planet under favorable atmospheric conditions, even when its diameter is reduced to as little as 7″. Besides the five cases above described, where curious and marked changes of detail observed in 1913, 1924, and 1925, and therefore predicted for 1926, have been verified with more

PLATE VII

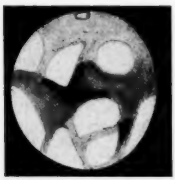


Fig. 1
'24 Oct. 19, 270°
278°.4 Dec. 25

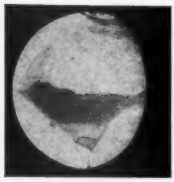


Fig. 2
'24 Dec. 23, 294°
317°.0 Jan. 33

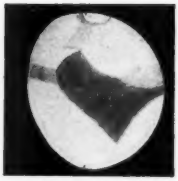


Fig. 3
'26 Aug. 19, 261°
266°.6 Dec. 6

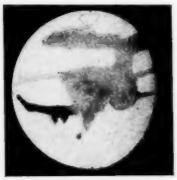


Fig. 4
'24 Oct. 5, 29°
269°.7 Dec. 11

Fig. 5
'13 Sept. 17, 36°
320°.9 Jan. 40

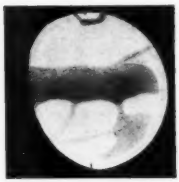


Fig. 6
'26 Sept. 12, 33°
281°.6 Dec. 30

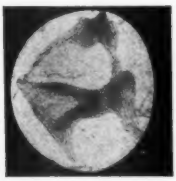


Fig. 7
'24 Dec. 13, 38°
311°.3 Jan. 23

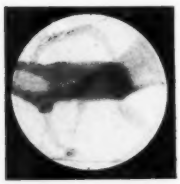


Fig. 8
'26 Nov. 26, 29°
325°.4 Jan. 48

Fig. 9
'24 Nov. 8, 60°
290°.7 Dec. 44

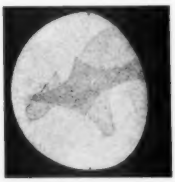


Fig. 10
'25 Jan. 19, 60°
331°.9 Feb. 3

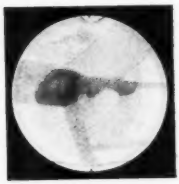


Fig. 11
'26 Nov. 26, 62°
325°.4 Jan. 48

Fig. 12
'24 Nov. 10, 359°
291°.9 Dec. 46

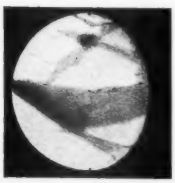


Fig. 13
'24 Dec. 21, 1°
315°.9 Jan. 31

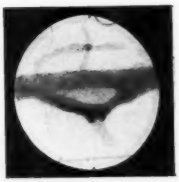


Fig. 14
'26 Dec. 1, 1°
328°.2 Jan. 53

DRAWINGS OF MARS.

PLATE VIII

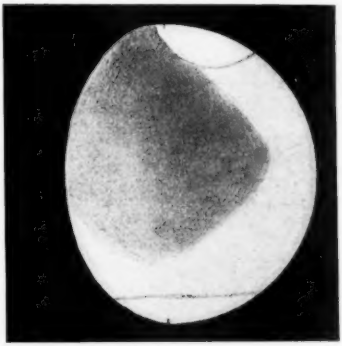


Fig. 15
'26 June 27, 121° 9″3
232°.7 Nov. 9, —22°.2

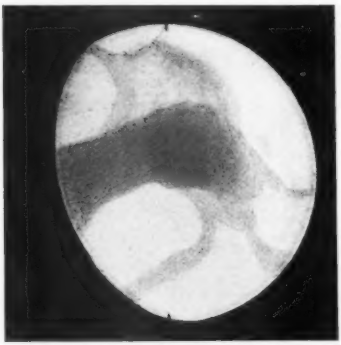


Fig. 16
'26 Aug. 7, 74° 12″1
259°.1 Nov. 50, —17°1

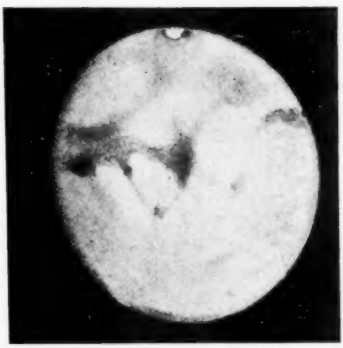


Fig. 17 Phillips
'26 Sept. 5, 82° 15″1
277°.3 Dec. 23, —13°.2

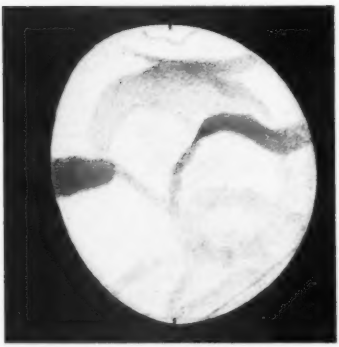


Fig. 18
'26 Sept. 5, 119° 15″1
277°.3 Dec. 23, —13°.2

Fig. 19 Wilson
'26 Oct. 20, 60° 20″2
304°.5 Jan. 12, —14°.2

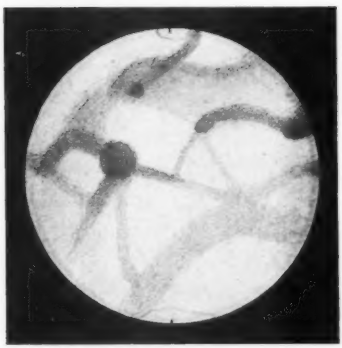


Fig. 20
'26 Nov. 17, 119° 18″8
320°.4 Jan. 39, —18°.6

DRAWINGS OF MARS.

or less accuracy, there are about a dozen more, where less marked changes have occurred, but where the resemblance between the drawings for the different years is about equally close. Perhaps the most striking of all those that were predicted, however, remains yet to be described, but since the appearance at one time was distinctly different from that noted in 1924, it has been thought best to place it in a class by itself.

Changes in Thaumasia.

This curious phenomenon was first recognized in Arequipa in 1892, but seen to much greater advantage thirty years later, and again at the last apparition. It has been recorded by us about a dozen times on many different drawings, but does not seem to have been noted elsewhere, or at all events described. It appears to be associated with the melting of both of the polar caps, and consists in a simple darkening of the whole region of Thaumasia, and sometimes of the region surrounding it, so that neither Solis nor the great canal Agathodaemon are visible, nor can we distinguish Thaumasia from Aurorae and the region to the south of it.

My first observation of Mars in 1926, with my new 12.5-inch Calver reflector, was made on June 27, $\odot$ 232°.7, some four terrestrial months before any notable changes were expected to take place on the planet. Judge then of my surprise to find nearly half of the disk darkened, Figure 15, and no other recognizable detail, save the two polar caps, visible upon it. The diameter of the planet was 9″.3, the seeing 6 and 7, and the latitude of the center —22°, as stated beneath the figure. The region that I expected to see was that of Thaumasia. Figure 20 is drawn with very nearly the same central latitude and longitude, and although its detail has an unfamiliar aspect, yet it will serve to show the region of the planet that was under inspection. The circular dark spot to the left of the center is Solis. More than halfway from it to the left limb lies Aurorae, while the dark area slightly above it and to the right of the central meridian is Sirenum, with Titanum close to the limb. The bright area of Thaumasia lies between Aurorae and Sirenum. This region we see by Figure 15 is completely darkened. Titanum is covered by limb cloud and is invisible. Aurorae in this figure would be beyond the terminator. This drawing is confirmed by a similar one made by Mr. Wilson the next night, central longitude ω 64°. The same region is shown in a more familiar aspect but with a different central longitude in Figure 19.

Our next drawing which is not shown here, was made on July 3, ω 57°. The dark area had notably diminished in size, being of about the same size as the darker portion of Figure 16, but of an entirely different shape. This was mainly due to a different distribution of the terminator and limb clouds. There is in the earlier drawing, however, a broad dark band reaching from the western side of the southern polar cap towards the center of the disk, confirmed by another drawing made

on July 5, and also by one of Mr. Wilson made on June 29, ω 58°, but which is not found in Figure 16. This broad band evidently dried up, since it crossed at right angles the place of the similar, but much narrower band shown in the latter Figure. In the earlier drawing the eastern portion of Thaumasia is still completely darkened, while the western is covered by a dense bright cloud.

A curious fact must now be mentioned. The solar longitude ⊙ when this drawing was made was 237°.1. In 1924 Thaumasia was perfectly clear at this Martian season, as shown by two drawings by Phillips and Du Martheray made on the nights of terrestrial August 12 and 15, ⊙ 235°.6 and 237°.4, Report No. **35**. Indeed the very best drawings of the planet in 1924, when it was nearest us, were made in the solar longitudes between 229° and 262°, whereas between these Martian dates in both 1922 and 1926 the planet was densely clouded. Just think what we should have missed if we had had the 1926 Martian weather in 1924! Similarly the Martian season that gave us our very best results in 1926, ⊙ 300° to 326°, Martian dates January 4 to 49, was particularly cloudy and unfavorable in 1913, 1924, and 1925. The drawings made during this period in 1926, when the planet was nearest us, and when these regions were all particularly clear, will appear in a later Report, in connection with those of the other observers. Two of these drawings, however, are shown here in Figures 19 and 20. The former may be compared with Figures 5, 7, and 10, of nearly the same region, made in 1913, 1924, and 1925, at nearly the same season of the Martian year. Again in 1922 which was also a close apparition, the planet's atmosphere was filled with cloud until two weeks after the date of opposition, which then came quite early in the planet's year, but it then cleared off, and gave us splendid views for the twelve weeks following, after which heavy precipitation again occurred, blotting out many of the most interesting features.

There appear to be two fairly defined cloudy seasons on Mars, one in the late summer and one in the late winter, about the time when the snow caps are largest. Another cloudy season lasting eight or ten weeks sometimes occurs between them in the autumn. These facts are illustrated in Figure 21. Sometimes the beginnings and endings of these cloudy seasons are well marked, especially if they occur near the time of opposition, when the planet is well seen. At other times they seem to fade away, or to alternate with short periods of clear weather. In the Figure the abscissas at the top are solar longitudes. At the bottom are given the corresponding Martian months. Four terrestrial years are shown at the left hand. The heavy lines indicate the cloudy spells, and the dots the periods when they are uncertain. The three short vertical lines indicate the dates of opposition. Thus in 1922 we see that the planet's atmosphere cleared immediately after opposition. In 1924 there was a very long clear spell possibly beginning in Martian September. The best drawings were secured at about the time of opposition in November. We see, however, that both in 1922 and 1926 the

planet was clouded at this time. In 1926, as predicted in Report No. **36**, the clear spell terminated at about the time of opposition, and the winter cloudy season began in late Martian January—our December. It may be mentioned in this connection that in 1892 opposition occurred the last of Martian October, and that all of October and November were clear, a long cloudy spell occurring in September. Whether the supposed Martians are able to control their weather, or whether as with us it is merely a question of chance, we were certainly very fortunate at all four of these close apparitions of the planet, to have their clouds clear off at the times when it was nearest to us, and we could observe it to the best advantage.

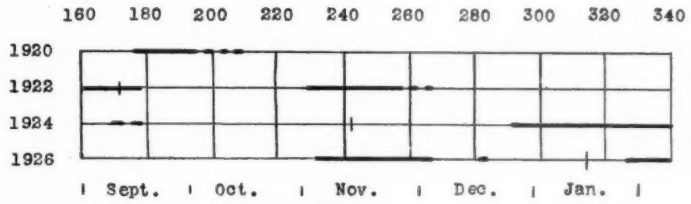


FIG. 21.
CLOUDY SEASONS ON MARS.

Our next two drawings of this region were made on August 1 and 5, ω 124° and 49°. In the first, heavy clouds prevailed over Thaumasia, and probably to the north of it. In the second, clouds covered the surface all around the limb and terminator, leaving visible only a little central dark area, and the southern polar cap. Two days later a general clearing occurred, and in Figure 16 we note that the longitude of the central meridian, ω 74°, differs but little from that of Figure 17. From this we see that Thaumasia is still dark, and the *mare* to the west of it still covered by cloud. A number of observers in response to my request have kindly sent me drawings of this region, but as far as I can determine from my own drawings and from those of Mr. Wilson, the earliest other observer, Thaumasia was probably dark all the time from June 27 through August 7, and the lightening detected on August 1, which showed no detail, was I believé, as above stated, due merely to Martian cloud. We must notice that Figure 16 indicates that the darkening extends to nearly 5° north of the equator in longitude 106°, or to about 20° north of Phoenicis.

Our next drawing, Figure 17, is by Mr. Phillips, who seems to have been the first observer to clearly see surface detail in Thaumasia itself at this apparition. The first drawing that he sent me was dated August 27, but the only noticeable difference between it and the one here shown is that the short prolongation of Solis towards the south, indicated in the Figure on the central meridian, crossed the bright space between Solis and the polar cap. This canal is shown by Wilson and others, though I myself did not see it. This drawing must certainly look singu-

lar to those who have been accustomed to this region only during the last dozen years. The very curious meridional pointed shape of Solis strikes us at once. This I believe has never previously been noted, although often in the past it has been recorded as round. It was last observed as fairly round in 1901, but not so completely so as it appeared somewhat later in the past apparition. A very striking disappearance is that of Agathodaemon between the lakes of Maeisia and Phoenicis, also of the dark boundary of Thaumasia immediately to the south of Sirenum.

Our next drawing, Figure 18, was made on the same day as that of Mr. Phillips, and only two and a half hours later. It has the same central longitude as Figure 20. Its most striking feature is the great width of Nectar, which is on the terminator, and appears here as a broad band. This is confirmed by a similar drawing made on the previous night. Objects near the limb and terminator are never as well seen as when near the central meridian, but it is certain that they sometimes undergo a distinct change of shape under a low sun as distinguished from that which they present when the sun is high. In both Mr. Phillips' drawing and mine, Araxes, which descends from Sirenum to Phoenicis, is convex to the southeast, instead of to the northwest as is customary, implying a temporary shift of location. The break in the southern boundary of Thaumasia just south of Sirenum, which is shown in his drawing, has been closed in mine, and a number of northern canals have appeared which would have been too near the limb for him. When Solis was near the central meridian two days later, I drew it nearly circular, but slightly longer in a meridional direction. Mr. Phillips also sent a drawing dated October 6, $\omega 74°$, which shows Solis of much the same shape as in Figure 17, but more blunted at the north. The curious feature, however, is that it is now divided into three parts, as if it were crossed by two narrow, parallel, east and west clouds, one lying north of the other. The northernmost of these clouds he also shows on October 2. He represents the southern canal from Solis as again complete, while the one towards the southwest is now missing. Changes in the southern boundary of Thaumasia have also occurred. These effects are all of them probably attributable to shifting clouds. A drawing by Schofield dated October 31, $\omega 60°$, shows Solis separated from Nectar by a small narrow cloud lying in a north and south direction.

Figure 19 of October 20 by Mr. Wilson is interesting for several reasons. In the first place, except for the missing section of Agathodaemon, the general appearance of Solis and Thaumasia is much what we have been accustomed to during the past twelve years. In our previous drawings we may have noticed that Nectar apparently sometimes occupies two different positions, its eastern end being at times further north than its western one, in which case it is nearly in contact with Agathodaemon, as in Figure 9, and at other times it seems to lie to the south of it, as in Figures 17 and 20. Whether it really swings back and forth, or whether there are two separate canals whose appearance

usually alternates is not certain, but Wilson's drawing, Figure 19, where both are shown at the same time clearly implies that the latter is the case. He also shows a little lake and a very narrow canal just to the north of Nectar. He shows this lake also on October 15. We secured no drawing of this region on or between these two dates, and only an inferior one on October 26. Schofield, however, has sent a drawing from Japan, dated October 25, showing Nectar as a triple canal, but he does not show the little lake. Otherwise it confirms Wilson's drawing. It also confirms the "irrigation" canal of 1924. Although our drawing of October 26 was a poor one, with bad seeing, yet together with Schofield's it does seem to confirm Wilson's representation of Thaumasia and Solis as having returned to their customary form. This is the more important because our last drawing, Figure 20, made four weeks later, November 17, shows that they had then again resumed their appearance as first recorded by Phillips. It shows the southwestern boundary complete, but a part of Agathodaemon still is missing. Solis appears very nearly round, and a long well marked canal, Tithonius-Fortunae, extends from it towards the north pole. This canal is clearly confirmed by Wilson on October 14, and was very pronounced in a drawing made by myself on October 12. It was evidently not a permanent feature however. Most of the northern detail shown in the Figure was confirmed on this latter date. In December Thaumasia darkened again, at first appreciably less than the surrounding *maria*, but later it was indistinguishable from them. On December 27 and 28 the central portion of the disk alone showed detail, the rest being completely hidden by cloud. In our drawings in early January, the whole Martian sky was filled with such dense haze that the *maria*, even where darkest, were only slightly darker than the desert regions. Later the sky cleared, but when the Thaumasia region again became visible to us, January 28 to 31, nothing could be seen but dense Martian cloud, Seeing 9. The diameter at this time was 9″.

An interesting feature of this past year's observations was the various shapes attributed to Solis by the different observers. Its mean diameter in the case of Figure 20 was 470 miles. It was therefore by no means a small object. Wilson gave it an indefinite but changeable shape in September, gradually assuming the usual elliptical form of former apparitions in October. In November he saw it more or less rounded, but on Nov. 22 the pointed shape given by Phillips was recorded. Ellison in Ceylon and Schofield represent it as rounded in October. Ellison surrounds it with projecting bays where the canals enter it. To myself both before and after October, its shape when near the central meridian was elliptical, with its major axis lying in a meridional direction, the ratio of the two axes being about 1.16. A striking exception is shown when near the terminator in Figure 18. In one of my drawings on October 12 it was rhomboidal, with a strongly inclined major axis, while only two hours earlier it had shown the usual elliptical form. Twice in November it was drawn circular, with a

fainter extension towards the north. Including this gave it the pointed shape of Figure 17.

Regarding the general phenomena of the apparition as foretold in Report No. **36**, we saw more than we had expected in November, but about what we stated was likely to be the case in September, October, and December. Opposition occurred on November 4. Our most interesting views were obtained in September, October, and November. It was stated that the southern snow cap was expected to disappear as snow about the middle of our August. It was last seen continuously as such on August 19, but reappeared at intervals for a day or two at a time throughout September and October. As an individual cloud it was last seen on December 1. Extensive cloud formations appeared along the limb and terminator, and at times over a large part of the surface of the planet both before and after opposition. A few meridional bands appeared towards the end of November, notably between longitudes 0° and 60°, but it is still rather early for them, since they have usually developed heretofore in the late Martian winter and early spring.

Private Observatory, Mandeville, Jamaica, B. W. I.,
January 31, 1927.

THE FIREBALLS OF DECEMBER 9, 1926.

By A. L. BENNETT.

On December 10, we at the Lowell Observatory learned that a brilliant meteor had been seen the previous evening. It seemed that the object was of unusual size and not far distant. We thought, therefore, an investigation would be worth while.

It had been snowing on and before December 9. At the time of the appearance the clouds had partly broken away, permitting many of the observers to see the fireball clearly. In some sections, however, especially to the southwest, the sky was covered with heavy clouds; some localities were having snow. We attribute much of the confusion and contradiction found in the reports to this condition.

Reports from thirty observers and two other composite reports, from men who interviewed a number of observers and sent us a summary, have been received.

The object was so brilliant that the attention of a great many people, even indoors, was attracted by the light. By those who saw it it is described, for the most part, as a mammoth sky rocket. A large ball coursed across the sky, leaving a trail of red sparks behind it. While still at a considerable height, the ball burst with a blinding flash and soon after that the fragments ceased to emit light. It was seen at least as far south as Tucson. The various observers report the appearance as follows:

Flagstaff. "First seen somewhat east of zenith. Very large head, followed by tail ten or fifteen times as long as broad. Most of the light seemed to come from tail. Head red in color, tail giving off intense blue-white light." "Appeared like skyrocket when it burst 30° or so above horizon." "Consisted of central ball surrounded by a number of smaller balls. No trail noticed, although fireball appeared several times as long as broad." "Appeared like great skyrocket, pieces dropping at different points."

Prescott (65 miles due southwest from Flagstaff). "Seemed like a big skyrocket exploding and falling." "Left a trail of lights."

Superior (S 15° E 130 miles). "Apparently it was breaking into fragments and close to earth, as it resembled a huge rocket having exploded in the air."

Tucson (S 10° E 200 miles). "The meteor appeared to be very large, about ten or twenty times as large as our largest planets appear on a clear night. It was very large, blue-white in color, and the heavens were completely lighted up for a brief space of time. The meteor did not appear to drop very fast, was easily observed, and had a rather short trail of yellowish red sparks trailing out behind in the curve through which the object was falling. These sparks were very large as they were leaving the object, growing smaller toward the trailing end."

Claypool (S S E 130 miles). "Meteor appeared to disintegrate about 15° above horizon. About six large pieces broke off and retained brilliance for a moment. The main part was of a high color, from a deep ruby red to redder."

Casa Grande (155 miles due south). "It was casting off fragments, some of which were equal in size to any of the planets. It appeared to me more like a skyrocket than anything I had ever witnessed."

Florence (S 5° E 150 miles). "The meteor appeared very much like a skyrocket, as I could plainly distinguish green and red light."

Winslow (E 12° S 55 miles). "Similar to a comet when first seen, remaining the same for a long distance. Appeared as a ball of fire surrounded by a halo of light, followed by tail of fire. It followed a rainbow curve, then fell straight toward the earth."

On road between Drake and Del Reo (W S W 50 miles). "Coming nearly horizontally. Burst, and dropped like molten lead poured from a ladle."

A number of observers report a noise following the appearance, as follows:

Flagstaff. Long rumble estimated from a few seconds to a minute after the flash.

Winslow (E 12° S 55 miles). Explosion heard 2½ minutes after meteor disappeared.

Vicinity of Sedona (S 15° W 20 miles). "Hissing noise simultaneous with the light." Two parties "distinctly felt the reverberation of its striking the earth." Another "heard no noise until it fell, then there

was a heavy jar, mingled with a sort of reverberation." Interval estimated at one to two minutes.

Mormon Lake (20 miles SE). Continuous roar after 10 or 15 seconds interval.

Clarkdale (35 miles SW). "Sound similar to a freight train, more of a rumbling sound, and the report when it struck the earth was heard possibly two minutes after the light had disappeared, sounded like a heavy blast, and rumbled and echoed through the hills for several minutes."

The train left behind the fireball received slight mention. The only references to it are as follows:

Prescott (65 miles SW). "A train of milky light that persisted some seconds."

Winona (14 miles east). "Left a bright streak behind it as it went across the sky which gradually went out as the meteor disappeared."

Cottonwood (40 miles SW). "....leaving behind it blue smoke and sparks."

The time of the event is generally estimated at about 8:30. An observer near Superior looked at his watch immediately and said it occurred at exactly 8:25. When questioned upon the accuracy of the timepiece, he wrote that "8:27 P.M. would be correct, that is, as far as our time here, which varies somewhat from actual mountain time." An engineer on a Santa Fe freight locomotive gives the time as about 8:28.

The duration of the phenomenon is estimated, "a full second or slightly more—not quite two seconds"; "two or three seconds," by observers who seem to be competent.

The bearings given are of such an approximate nature that it has been impossible to locate exactly even the end point of the path. One man who noted the point carefully refused to give us the bearing, stating that he was negotiating with men to search for fragments. Recently some meteoric material from northeastern Arizona was reported to have been sold to a museum for a large sum. The publicity of this transaction apparently gave the impression that all meteorites are of fabulous value. The data we have follow:

Flagstaff. "Somewhat E of zenith when first seen. Disappeared in S SE direction." "Slightly W of Mormon Mountain."

Winslow (E 12° S 55 miles). "Disappeared about SW on line with S portion of Hay Lake. Seen through Sunset Pass. Seemed to be going almost S."

Winona (E 14 miles). It traveled almost N and S, but was at just enough of an angle to make it NW to SE.

Clarkdale (35 miles SW). "....fell, as near as we could guess, about in the center of the triangle formed by Sedona, Flagstaff, and Stoneman Lake."

Puntenny (W 10° S 45 miles). "It was due E from here, traveling in a southerly direction."

Prescott (65 miles SW). "When I first saw it, it appeared about E

15° N, about 45° above the horizon, and disappeared about NE, about 10° or 15° above the horizon."

Jerome (40 miles SW). "It must have hit close to Sedona."

Superior (S 15° E 130 miles). "....moving S by W, last seen slightly W of N."

Ray (S 15° E 145 miles). "Traveling SW, falling rapidly."

Claypool (S SE 130 miles). "Seemed to come from N NE direction. Angle with horizon about 45°."

Tucson (S 10° E 200 miles). "Seemed to be N 10° or 15° W, traveling W and toward the earth at an angle of about 45° to 50°."

Soldier Lake (S 40° E 35 miles). "Light seemed to come from NW."

The data seem to indicate that the point where the bolide burst was over a region west of Hay Lake, about 30 miles S SE of Flagstaff. That region is very rugged, and inaccessible during the winter months. It is practically uninhabited.

We have communicated with one observer whose report does not seem to apply to this fireball. He was driving an automobile about 50 miles SW of Flagstaff and about 50 miles W SW of the probable end point of the path of the previously described object. About 8:30 he saw a single blue white ball of fire falling probably less than 15° from vertical. The altitude was close to 60° when it went out completely. It was snowing at the time, but the object was clearly visible during the latter part of its course. It seemed to be moving in a slightly west of north direction, and disappeared just east of north. He seems certain that he could not have been seeing the fireball before described. We have heard, from a man in Prescott, that he believes a number of other people in that vicinity saw this body.

Lowell Observatory, Flagstaff, Arizona, February 2, 1927.

THIRTY-SEVENTH MEETING OF THE AMERICAN ASTRONOMICAL SOCIETY.

[*Continued from page 143.*]

SYSTEMATIC DIFFERENCES IN DOUBLE STAR MEASURES.

By Chas. P. Olivier.

With the improvement in methods and the demands for higher accuracy in sidereal astronomy, the systematic differences of observers who have measured a fairly large number of double stars become of interest. The writer has for some years been aware of small differences between his measures and those of certain other observers, so he has collected the results of a comparison of his own measures relative to those of two of the best observers in this field, namely Aitken and Hussey. A comparison of the writer's measures with those of

Jonckheere, on doubles discovered by the latter, has already been published (*Astronomical Journal*, **30**, 157, 1917). There it was shown that Jonckheere measured distances considerably closer, but little systematic difference in position angles was found.

For Aitken and Hussey the material at hand is probably more homogeneous, also their discoveries average brighter than Jonckheere's. All the measures here used for comparison, and made by Aitken and Hussey, are taken either from Burnham's or Jonckheere's catalogues. The doubles discussed consist wholly of discoveries by Aitken and Hussey. The measures by the writer were made from ten to twenty years later, hence motion may have taken place in some pairs. Out of 200 available pairs, 6 were rejected for this reason. For the other 194, as the indicated motions are very small and hence as likely really to have been in one direction as the other, it is assumed that they remained fixed, nor is appreciable error so introduced. All the 194 measures were made with either the McCormick 26-inch or the Lick 12-inch refractor; 79 per cent with the former. The table illustrates the results.

	Aitken — Olivier		Hussey — Olivier	
0″- 1″	—0″.047	31	+0″.053	11
1 - 2	—0.097	74	+0.060	44
2 - 3	—0.052	16	+0.193	9
3 - 4	+0.070	3	+0.195	2
Greater than 4	—0.022	4	.....	0
Mean	—0″.074	128 stars	+0″.083	66 stars
	+0°.10		+0°.67	
Average	±0″.109		±0″.130	
Differences	±2°.42		±2°.38	
On photographs	—0″.13	7 stars	+0″.08	14 stars

While the total number of pairs available is not great enough for definitive conclusions, yet it is difficult to see how the systematic differences derived, though gratifyingly small in both coördinates, can be purely the result of chance where the distances are concerned. The systematic differences in position angles are vanishingly small. It is also seen that the Aitken and Hussey pairs measured have a good distribution in distance from 0″.4 to 3″. The vast majority were less than 2″, and only 9 out of the 194 were over 3″. It will be further noted that the 21 available measures of stars on photographic plates, made here, tend to confirm the reality of the distance corrections for the visual measures. These 21 are, however, too few to have much weight.

SOME SYSTEMATIC FEATURES IN THE DISTRIBUTION OF STARS.

By Frederick H. Seares.

A study of surface densities observed in many parts of the sky reveals periodic variations in

$$\Delta = \log N_{obs} - \log N_{mean}$$

which for a given latitude can be represented by a cosine term depend-

ing on the longitude. Differences between the two galactic hemispheres indicate the necessity of a correction to the adopted position (Gould's) of the galactic pole. The resulting equation of condition

$$\Delta = s \pm G + F \cos (\lambda - L) \mp k \cos (\lambda - L_0)$$

(upper sign for N galactic latitude, lower for S) provides for a correction to the pole, and, otherwise, may be interpreted as the first-order effect of an eccentric location of the sun within a symmetrical stellar system; s is a possible systematic correction to the mean distribution table; k depends on p, the polar distance of the true pole, in longitude L_0, relative to the adopted pole. G depends on the perpendicular distance of the sun from the galactic plane, and F on its distance from the center measured in this plane; both quantities also depend on the latitude and the space-density function. $2F$ is the logarithm of the ratio of the numbers of stars in longitudes L and $180° + L$, where L is the longitude of the center of the stellar system.

The application of this equation to data from the Mount Wilson Catalogue of the Selected Areas, the Harvard-Groningen Durchmusterung, and many zones of the Astrographic Catalogue, all referred to the international photographic scale, gives the results tabulated for different limiting magnitudes m.

m	L	L_0	p	$2F$	$2G$
9.0	267°	275°	8°.1	0.380	—0.127
11.0	270	296	6.8	0.434	—0.101
13.5	275	319	8.0	0.429	—0.095
16.0	319	357	4.1	0.690	—0.012
18.0	319	350	2.7	0.668	+0.002

The values for L, L_0, p, and G are means of accordant results for latitudes 0°, 5°, 10°, 20° . . . 70°. F decreases with increasing latitude, and its values cannot be directly combined, those given being means for 0° and 5° only. The star ratio in the galactic plane for longitudes L and $180° + L$ increases from 2.5 for $m = 9.0$ to about 5 for $m = 18.0$. An average of 4 for all magnitudes, combined with the space-density law of Kapteyn and van Rhijn, leads to an estimate of 1200 parsecs for the distance of the sun from the center of the stellar system revealed by present-day telescopes. The values of G indicate that the sun is almost exactly in the galactic plane of the systems defined by stars brighter than the 16th or 18th magnitude. An appreciable asymmetry occurs only when the limit is of the 14th magnitude or brighter.

The progressive changes in L, L_0, and p shown by the table, together with results by others, indicate that the systems defined by successive limits of brightness, from the fifth magnitude downward, are neither concentric nor oriented exactly alike.

If this phenomenon is to be ascribed to the influence of a local cluster, the cluster must be very large, for faint stars are involved, situated at distances much greater than the 500 parsecs within which are included most of the isolated B stars. The results suggest a pro-

gressive change in the characteristics of stellar distribution analogous to that shown by Strömberg to be a feature of stellar motions.

PHOTOGRAPHIC AND VISUAL OBSERVATIONS OF MARS IN 1926.

By E. C. Slipher.

There was presented a series of slides, showing changes on the planet from April to December, 1926, also a comparison with photographs during the years 1909 and 1926. During the current year, ordinary or blue photographs showed mostly the atmospheric phenomena of Mars, while yellow and red color-filter photographs gave details on the planet's surface. The blue photographs showed no cloudiness from June to October 8, but after that time there were usually cloudy areas. Other features were temporary dark areas shown on the blue photographs, but not detected on the yellow ones, or by visual observations. The whole series of slides exhibited continued and conspicuous changes on the disk of the planet. (Ed.)

TWO TELESCOPES OF HISTORIC INTEREST.

By Frederick Slocum.

Loomis, in his "Recent Progress of Astronomy, Especially in the United States" (1850), describes the larger telescopes in the United States, from the Yale 5-inch refractor (1830) to the Harvard 15-inch (1847).

The two telescopes described in the present paper are not mentioned by Loomis. The first is a 6-inch Gregorian reflector made by Watkins and Smith of London and equipped with a Dolland "Catadioptric Micrometer," or heliometer. This telescope was made for Benjamin West of Providence, and was used by him to observe the Transit of Venus of 1769. The telescope and heliometer, both in good condition, are in the Ladd Observatory of Brown University. A 22-page pamphlet by West was published in 1769, describing the instrument and the observations made with it.

The other telescope is a 6-inch refractor made by Lerebours of Paris for Wesleyan University in 1836. It is in the Van Vleck Observatory of Wesleyan University, in excellent condition. It was probably the largest refractor in the United States until 1840. The certificate of the test of the lens, signed by P. Arago, director of the Paris Observatory, is in the archives of the Van Vleck Observatory.

THE PARALLAX OF ALPHA CYGNI.

By Carl L. Stearns.

This star is of special interest on account of the difficulties attending the determination of its parallax, either trigonometrically or spectroscopically. Its trigonometric parallax was found to be $-0''.009 \pm$

0″.007 from a series of 32 plates taken with the 20-inch refractor of the Van Vleck Observatory. The mean of this and three other trigonometric determinations, making due allowance for systematic errors, is probably less than zero, while the mean of three values spectroscopically determined is +0″.046, emphasizing the need of further investigation of stars with this type of spectrum.

The parallax of α Cygni was the first to be measured at the Van Vleck Observatory. A comparison of its probable error with those of the parallaxes of two faint stars subsequently measured indicates that it will be possible to measure the parallaxes of the first magnitude stars with a satisfactory degree of precision, using a double, or differential, occulting sector to reduce the light.

The other two parallaxes measured, those of BD+19°869 and a fainter star 2′.5 west and 4′.6 south, were found to be +0″.035 ± 0″.009 and +0″.075 ± 0″.011 respectively. The fainter star was found to have a proper motion of 0″.4 in position angle 40°.

SECOND REPORT ON THE LIGHT-VARIATIONS OF THE SATELLITES OF JUPITER AND THEIR APPLICATION TO MEASURES OF THE SOLAR CONSTANT.

By Joel Stebbins.

The definitive reduction of the observations of Jupiter's satellites, which were described at the Nantucket meeting, confirms all of the conclusions there presented. Each satellite has an orbital light-curve which indicates that the times of rotations and revolution are the same; also, each satellite is like our moon and the asteroids in brightening up at the full phase. During the three weeks of continuous observation any variation of the sun must have been small, as the mean residual for a night's result on three satellites was ±0.004 magnitude, or four-tenths of one per cent. Complete publication in the *Lick Observatory Bulletin*.

CANADIAN WORK ON THE INTERNATIONAL LONGITUDE NET.

By R. Meldrum Stewart.

In connection with work on the International Longitude Net, carried out during October and November, 1926, under the auspices of a joint committee of the International Astronomical Union and the International Geodetic and Geophysical Union, two points in Canada, Ottawa and Vancouver, were occupied.

At Ottawa two instruments were employed, the six-inch meridian circle and a three-inch astronomical transit. The program adopted for the meridian circle included the usual belt of equatorial stars, together with all stars on the program of the other Canadian instruments, which extended from about twenty degrees to sixty degrees north declination. A full night's work comprised about sixty star observations, divided into evening and morning groups, together with observations on merid-

ian marks and the usual determinations of instrumental constants. With the field transit a full night's work consisted of four time determinations, two in the evening and two in the morning. Two Riefler clocks were employed, under the usual conditions of constant temperature and pressure; they were chronographically compared twice each day. Time determinations were obtained on thirty-three nights, though many of these were not complete. There were two gaps of four nights without observations and two gaps of two nights, as well as a number of one night.

At Vancouver two field transits were employed, one of the straight type similar to that used at Ottawa, the other of the broken type. Only one clock was available, which was kept under constant temperature but not under constant pressure. In lieu of a second clock a gravity pendulum was employed, swinging in a constant temperature room and under the usual conditions of low pressure. Individual swings were of twenty-four hours duration, and comparisons with the clock were made a number of times each day. This pendulum was kept swinging throughout the whole period except for a few days' interruption due to leakage of the case. So far as star observations were concerned, the season was about the worst that could have been chosen for Vancouver. The observers were fortunate, however, in obtaining more than the usual share of fair weather; time determinations were secured on twenty-five nights, though comparatively few of these were complete. There were single gaps of eight, seven, and six nights, as well as others of shorter intervals. The observations secured should, however, be sufficient for a fairly good longitude determination.

At Ottawa, wireless time signals were received from Annapolis, Bellevue, Honolulu, Bordeaux, and Nauen, all by the method of coincidences by extinction. Saigon was not heard on either the long or short wave, and the short-wave signals from Honolulu were likewise not heard. The number of signals well received was seven hundred and twenty-nine.

At Vancouver the stations received were Annapolis, Bellevue, Honolulu, Saigon, and Bordeaux. Both the long and short-wave signals from Honolulu were regularly observed; the afternoon short-wave signals from Bellevue were not heard. The number of signals well received was five hundred and ninety-one.

Observations for personal equation were made at Ottawa by the various observers before the beginning of the longitude series, and are again in progress at the present time.

ON THE EFFECT OF DISTANCE UPON THE INTENSITIES OF DETACHED CALCIUM LINES.

By Otto Struve.

Intensity estimates of the detached calcium line [K] (λ3933) in 321 stars of spectral types O to B3 show that the intensity increases from 1.6 units on an arbitrary scale for magnitude one, to 3.6 units for

magnitude seven. One unit on the arbitrary scale corresponds roughly to 0.1 magnitude for the difference between the intensity of the continuous spectrum at λ3933 and the center of the line. The relation between arbitrary units and stellar magnitudes is practically linear. The probable error of a single intensity estimate is ±0.5 unit. For stars of the eighth and ninth apparent magnitude the figures indicate a decline in intensity, but the material is not sufficient to bring out this decline with certainty.

The distances of all 321 stars were computed from spectral type and absolute magnitude, and it was found that the gradual increase in the intensity of detached [K] from magnitude one to magnitude seven can be interpreted as an effect due to distance. The space immediately surrounding the sun and extending to a distance of about 150 to 200 parsecs, does not favor the production of strong detached lines. The strongest lines occur at a distance of about 500 parsecs from the sun.

The estimates on which these results are based were made, with the permission of the directors, at the Yerkes, Mount Wilson, Victoria, and Lick Observatories. The increase in intensity for the first seven magnitudes is verified by each of the different series of plates.

The complete paper will appear in the *Astrophysical Journal*.

NOTE ON THE DOUBLE STAR B.D.+66°34 = MILBURN 377.

By A. Vyssotsky.

On account of its large proper motion this star of the visual magnitude 9.5 has been included in the parallax program of the McCormick Observatory. The 12th magnitude companion was observed visually by the writer in August, 1923, and was discovered independently by W. Milburn. The position angle and the distance of the companion were measured on eleven of the plates taken for the determination of the parallax. The results are:

Date	p	d	n
1923.991	98°.9	2″.26	2
24.670	95.9	2.18	2
25.617	97.8	2.39	3
25.625	99.4	2.33	3
25.869	98.4	2.49	2
26.844	98.0	2.22	2
26.893	98.2	2.64	3
Mean	98°.2	2″.38	

The last column gives the number of images measured. As the proper motion of the star is 1″.7 in the position angle 96°, it is evident that the companion shares this large motion. The relative parallax measured by the writer is +0″.116 ± 0″.015, giving the absolute parallax +0″.120 and the absolute magnitudes of the components of this system respectively 9.9 and 12.4. The spectrum of the brighter star, according to Mount Wilson Observatory, is of the class M3.

ASTRONOMICAL AND METEOROLOGICAL CONDITIONS OF THE ECLIPSE OF THE SUN MAY 9, 1929, IN THE PHILIPPINES.

By MIGUEL SELGA.*

An eclipse of the sun, remarkable for the duration[1] of its totality, will take place in the Philippines on May 9, 1929. For the information of those who plan to come to the Philippine Islands to observe the eclipse, the following notes regarding the astronomical, meteorological, and transportation conditions may be of assistance.

Astronomical Conditions.

The Director of the *Nautical Almanac* kindly supplied the following particulars of the eclipse, in advance of their publication in the *American Ephemeris and Nautical Almanac*. The longitude and latitude of three points each on the northern and southern boundaries of the path of totality with the Philippine Standard Time of totality are as follows:

Time P.M.	East Longitude	North Latitude
	North Boundary	
$3^h\ 25^m$	119° 26′	11° 35′
3 30	122 37	11 33
3 35	126 19	11 20
	South Boundary	
$3^h\ 25^m$	120° 0′	10° 1′
3 30	123 9	9 59
3 35	126 49	9 47

The Philippine Standard Time is the time of the 120 meridian east of Greenwich and is kept throughout the Archipelago. The two most important towns of the region covered by the eclipse are Iloilo and Cebu. The approximate altitude of the sun above their horizon at the moment of the totality will be 38 degrees.

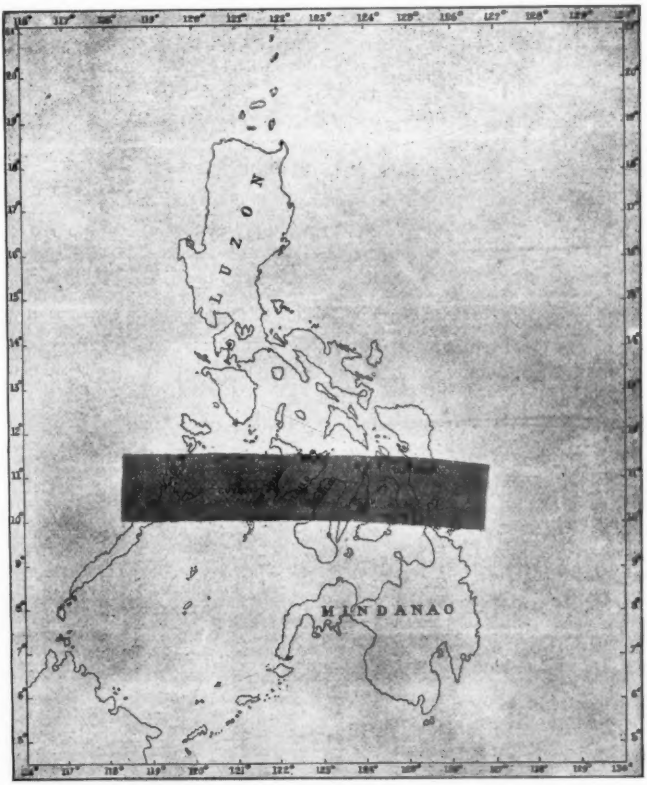
Meteorological Conditions.

The belt of totality stretches over a wide tract of the southern China Sea and northern Sulu Sea, but it also crosses several thickly populated islands of the Philippines, like Cuyo, Panay, Negros, Cebu, Bohol, Leyte, Samar, and Dinagat. The towns likely to be considered as prospective points of observation are the following, in order of longitude: Cuyo, San Jose, Iloilo, Capiz, Bacolod, Cebu, Ormoc, Maasin, Tacloban, and Guiuan. In almost all of these stations the Philippine Weather Bureau has maintained a meteorological station long enough to give a

*Director, Weather Bureau, Manila, Philippine Islands.

[1] Captain W. S. Eichelberger, Director of the *Nautical Almanac*, states that the maximum length of totality for this eclipse is 5 minutes and 7 seconds.—Ed.

fair idea of the cloudiness of the place and of its change from morning to afternoon hours. Table I gives the position of every station, the length of the period of observation, the monthly cloudiness at 6 A.M. and 2 P.M. for May in the usual scale of 0 clear, 10 overcast, and the average number of rainy days in May. In all the stations more than half of the sky is covered with clouds. San Jose, Iloilo, Bacolod, Or-



ECLIPSE PATH IN THE PHILIPPINE ISLANDS, MAY 9, 1929.

moc, and Tacloban show a tendency to increase of cloudiness in the afternoons. The May afternoons at Cuyo, Capiz, Maasin, and Guiuan are more free from clouds than the early mornings. Cebu shows a clearer and more uniform sky throughout. Out of two days in May one is rainy in Cuyo, San Jose, Capiz, Tacloban, and Guiuan. The conditions are better in Iloilo, Bacolod, Cebu, and Ormoc, only a third of the days of the month being rainy days, on the average.

TABLE I.

LOCATION AND OBSERVATIONS OF THE MAIN STATIONS.

Location, Island, Province	Long.	Lat.	Period of Observations	Cloudiness 6 a.m.	Cloudiness 2 p.m.	Rainy days
	° ′ ″	° ′ ″				
Cuyo, Cuyo, Palawan	121 00 24	10 51 22	1903-06 1910-25	8.2	7.4	14
San Jose, Panay, Antique	121 56 15	10 44 16	1903-04 1906 1908-25	6.9	7.5	15
Iloilo, Panay, Iloilo	122 34 15	10 41 40	1903-25	6.3	6.5	12
Capiz, Panay, Capiz	122 45 00	11 35 06	1903-05 1907-09 1911-25	7.3	6.0	14
Bacolod, Negros, Occ. Negros	122 56 43	10 40 00	1903-06 1908	6.9	7.4	12
Cebu, Cebu, Cebu	123 54 21	10 17 30	1903-25	5.4	5.4	11
Ormoc, Leyte, Leyte	124 36 23	11 00 17	1903-25	6.0	7.3	12
Maasin, Leyte, Leyte	124 50 22	10 07 39	1903-06 1907-25	8.1	7.9	6
Tacloban, Leyte, Leyte	125 00 06	11 15 08	1904-25	6.3	7.1	15
Guiuan, Samar, Samar	125 44 20	11 3 00	1912 1914-25	5.6	5.4	17

More detailed information for three localities can be obtained if we turn to the Annual Report of the Weather Bureau for consultation. This publication gives the cloudiness at 6 A.M., 10 A.M., 2 P.M., and 6 P.M. during 1903-1906 for Cebu and Iloilo, and during 1904-1906 for Tacloban. The average condition of the cloudiness in May is shown in Table II.

TABLE II.

FOUR-DAILY OBSERVATIONS OF CLOUDINESS.

Stations	Period of Observation	6 A.M.	10 A.M.	2 P.M.	6 P.M.
Iloilo	1903-1906	6.4	6.5	6.2	6.8
Cebu	1903-1906	5.5	5.5	5.6	6.0
Tacloban	1904-1906	7.0	6.9	8.0	7.7

Although the afternoon cloudiness of Tacloban is considerably greater than in the morning, the changes of cloudiness from morning to afternoon are very slight in Cebu and Iloilo. Here again Cebu leads Iloilo in clearness and steadiness of the sky.

In order to obtain still a better idea of the behavior of cloudiness in the region under consideration, I instructed the observers of Iloilo, Capiz, and Cebu to make hourly observations of cloudiness from sunrise to sunset during the period May 5 to May 15, 1926. Table III gives the average cloudiness for every hour.

It is clearly seen from these observations that Cebu was far ahead of Iloilo and Capiz in clearness of the sky in May, 1926. If the sky of Iloilo and Cebu remains as clear during the eclipse of 1929 as it was in the first fortnight of May of 1926, nowhere in the eclipse region of the Philippines better localities could be selected than Cebu and Iloilo.

TABLE III.

HOURLY CLOUDINESS AT THE MAIN STATIONS.

Hours	Capiz	Iloilo	Cebu
6 A.M.	6.9	4.8	3.9
7 A.M.	7.2	4.8	4.4
8 A.M.	8.5	4.9	5.4
9 A.M.	8.2	5.2	4.0
10 A.M.	6.2	5.0	4.1
11 A.M.	4.5	3.7	3.3
NOON	3.7	3.4	2.7
1 P.M.	3.6	3.5	2.0
2 P.M.	3.8	4.0	2.8
3 P.M.	3.8	4.5	2.1
4 P.M.	4.3	4.9	3.5
5 P.M.	5.2	5.6	4.5
6 P.M.	4.8	6.6	4.1

An up-to-date Campbell-Stokes sunshine recorder was installed in October, 1925, at the Sugar Central operated by the Hawaiian-Philippine Sugar Co., in Silay, Occidental Negros. The number of hours of sunshine recorded at the end of every month is as follows: 1925 November, 198.65 hours; December, 135.30; 1926 January, 137.30; February, 186.20; March, 247.46; April, 293.20; May, 225.65; June, 147.75; July, 129.20; and August, 155.75. That the figures for May are relatively low can be accounted for by the fact that an atmospheric disturbance in the China Sea to the NW of Luzon caused a change of normal conditions and gave rise to thick clouds and heavy rains. During the period May 5 to May 15, when the weather was still normal, the number of sunshine hours was as follows: May 5th, $8^h.65$; 6th, $8^h.90$; 7th, $10^h.20$; 8th, $8^h.85$; 9th, $10^h.00$; 10th, $10^h.15$; 11th, $9^h.75$; 12th, $10^h.05$; 13th, $10^h.25$; 14th, $7^h.55$; 15th, $9^h.30$.

The high pressure of 772 mm that prevails over Siberia in January and February is replaced in May by widely separated isobars giving a small barometric gradient throughout the Far East. In May the isobar of 758.4 encircles the islands of Panay, Negros, Cebu, Bohol, Siquijor, Dinagat, and Leyte. Unless an atmospheric disturbance sets in, May is the hottest month of the whole year. The winds of May are very variable in direction, with a tendency to blow from the SE quadrant in the afternoon. The percentage of calm winds in the Sulu Sea, specially around Cuyo is 9. Typhoons are rare in May but not an improbability. The typhoon of May 13, 1895, totally wrecked the Spanish steamer *Gravina* off the western coast of Luzon; the typhoon of May 10-17, 1896, passed over the town of Iloilo. The thunderstorms with their display of thunder and vivid lightning are rather frequent in the May afternoons.

TRANSPORTATION CONDITIONS.

With the exception of Cuyo, the transportation from Manila to the places of observation is frequent and convenient.

Cuyo. Only two small boats run from Manila to Cuyo on a schedule subject to weather and business conditions. Should any party intend to

go to Cuyo, it should either wait in Manila long enough to connect with the regular steamer leaving for Cuyo, or charter a boat to make the trip independently. The island and town of Cuyo are very small; all materials and supplies needed for the eclipse should be taken from Manila, as nothing could be obtained locally.

Tacloban. It is the Capital of the Leyte province and is situated at the southern entrance of the famous San Juanico Strait, between the islands of Leyte and Samar. One is sure of a weekly service at least in one of the medium size boats covering the distance of 373 miles between Manila and Tacloban in about 60 hours.

Iloilo and Cebu. These two towns offer the best opportunities to prospective eclipse observers. According to the official census of 1918, the number of inhabitants of Iloilo is 49,114 and that of Cebu is 65,502. To either of the two towns there is a bi-weekly service of comfortable steamers from Manila. The distance of 392 miles between Manila and Cebu is covered in about 30 hours; it takes about 34 hours to make the distance of 340 miles between Manila and Iloilo. Both cities are modern in every way in sanitation, hygiene, accommodation, sale of materials and merchandise of every kind. There are many ideal places in the outskirts of Iloilo and Cebu, where parties could be stationed for the observation of the eclipse. Dormitories, schools, colleges with open and spacious grounds would offer the best locations. Tools of every kind are available; the photographic materials are fresh; the transportation is quick; unskilled labor is abundant and cheap. Both towns are connected with Manila by cable and wireless.

The academic year closes in the Philippines about the middle of March; April and May are everywhere in the Archipelago vacation months, with the result that school buildings and grounds are vacated and would be easily available to scientific parties for the observation of the eclipse.

THOMAS OSBORNE PERRY.

By JOHN H. DARLING.

The death of Mr. Perry which occurred January 25, 1927, at his home in Oak Park, Illinois, terminated an active life of nearly eighty years. Mr. Perry was best known as an inventor, and as such achieved noted success. He was also an ardent lover of astronomy, and it is this trait that the present sketch is chiefly intended to bring out.

Born February 28, 1847, at Tecumseh, Michigan, he graduated in 1869 from the University of Michigan, receiving the degrees of A.B. and A.M. Continuing his studies at the same institution he graduated as Civil Engineer and Mining Engineer in 1872. Astronomy was included in the course in civil engineering, and in that subject he was

fortunate in having for his teacher Professor James C. Watson, noted as the discoverer of asteroids and comets and the author of *Theoretical Astronomy*.

Following graduation Mr. Perry's entire life was devoted mainly to his chosen vocation of invention. Probably his most important invention was the aermotor, a form of windmill developed from a very elaborate series of experiments and theoretical calculations, attaining an efficiency far greater than that of any other form of windmill previously constructed. His results, with details fully illustrated, are printed by the Government in a volume entitled "Experiments with Windmills—Perry," and forming volume No. 20 of "Water-Supply and Irrigation Papers of the United States Geological Survey." 1899. 97 pp.

THOMAS OSBORNE PERRY
1847-1927

For many years Mr. Perry was deeply interested in astronomy. He was one of a large class of our citziens who are fascinated by the wonderful facts of that noble science, a class which is rapidly growing in numbers in this country of educated men and women who take delight in learning of the fast developing discoveries and important theories relating to the constitution of the universe.

A manuscript prepared by Mr. Perry a year or more before his death, consisting of 44 typed pages, entitled "Life in the Universe," contains a quite comprehensive statement of the outstanding facts of astronomy and the allied sciences of physics, chemistry, and the structure of the universe, according to recent discoveries and theories; and expresses his views on some of the problems of cosmogony and the development of life. This was not written for publication, but for his own pleasure and for purpose of reference.

While not in accord with the biblical account of creation,—the creation of the material universe out of nothing,—nor with the theological conception of God, nor with the prevalent doctrine of immortality, he was inclined to regard the universe itself as the embodiment of God, or as identical with Him.

These views were not chilly or repulsive. Mr. Perry enjoyed the satisfaction and contentment which are the reward of the honest and ardent seeker after truth. He was also impressed with the inspiring thought of the probability of many other worlds more or less similar to the earth and peopled with intelligent beings, some very likely more highly developed than our present human race. As the earth may ultimately become unfit for habitation, this would present a rather gloomy outlook but for the fact that among other worlds there may be widely different stages of development, and among them always some in which life is in active progress. Thus he considered that life in general may perpetually endure.

Copious extracts from the manuscript were read at the funeral services. The document forms a memorial to its author more full and fitting than an inscription on stone, more than even the appreciative obituary notices which have been published.

Duluth, Minnesota, March 20, 1927.

LONG-PERIOD VARIABLE STARS AS PHYSICAL LABORATORIES.*

By PAUL W. MERRILL.

The investigation of long-period variable stars is really a branch of general physics, for we may well regard these amazing objects as stellar laboratories,—cosmic crucibles is Dr. Hale's striking phrase. We study them not only as astronomical bodies but as physical aggregates of matter and energy from which we can increase our knowledge of atoms and electrons and the fundamental laws which they obey. It seems incredible that we should be able to study the detailed structure of atoms by observing objects billions of miles distant and invisible to the naked eye, but this is one of the every-day facts of astrophysical research. It arises from the power of the spectroscope to make a ray of light reveal the circumstances of its origin, just as a letter shows where it was mailed—to any one who can read the postmark.

The light of a long-period variable is a long time on the way to us. The interval between its emission by the atoms of the star and its reception by the human retina or photographic plate at the end of a ter-

*Paper read at meeting of the A.A.V.S.O., October 23, 1926.

restrial telescope stretches over hundreds, or even thousands, of years. Studies of long-period variables by several methods have yielded fairly definite ideas as to their distances. These are conveniently tabulated according to the apparent visual magnitude at maximum as follows:

AVERAGE DISTANCES OF LONG-PERIOD VARIABLES.

Maximum Magnitude	Distance Light Years
3.0	130
4.0	200
5.0	330
6.0	520
7.0	810
8.0	1300
9.0	2000
10.0	3300

This table applies to stars of spectral types Me and Se, which include some 85 per cent of all known long-period variables. The N-type variables are probably somewhat more distant for a given apparent magnitude. As a matter of general information every member of the A.A.V.S.O. ought to know the spectral types of the variables he is observing.

The effect of the great distances of the variables is greatly to diminish the intensity of their light, but the *character* of each individual ray appears to be absolutely unchanged by its long journey through space. If it is red or blue when it leaves the star, it is red or blue when it arrives at the earth centuries later, and the minutest spectral details are accurately preserved. The mechanism by means of which light is transmitted is evidently a very exact one, able to carry a beam at terrific speed (186,000 miles per second) for centuries on end without altering its intricate structure in the slightest. Thus this light of a star can be analyzed just as if it came from a laboratory some ten feet away. The immense distances of the variables give no difficulty in this connection except to render their light inconveniently faint. The recourse of the observer lies in large telescopes and long exposures on sensitive photographic plates.

Long-period variables are particularly interesting spectroscopically because by watching for a few weeks we can see remarkable changes taking place. This is not true of stars in general, for in most cases we should probably have to watch for millions of years to detect any significant changes.

Our most precious possessions relating to long-period variables are the records of brightness from which in numerous cases nearly continuous light curves can be drawn for many years past. These give the setting, as it were, for the physical and chemical problems with which only the spectroscope is competent to deal.

One's first thought in regard to stars as physical laboratories is perhaps that they might be able to teach us something about matter under

pressures and temperatures too high to be attained in the laboratory, but that they would not be likely to add much to our knowledge of comparatively low temperatures and pressures. The following considerations bear on this second conclusion and show that it is not valid.

The surface temperature of a typical long-period variable is about 2300° C absolute at maximum, and several hundred degrees less at minimum. These temperatures are, of course, well within the range of laboratory research. Dr. A. S. King can, in fact, produce in the spectroscopic electric furnace temperatures much higher than those existing in any of the observable parts of variables such as o Ceti or R Hydrae. Moreover, he has actually imitated some peculiar features of the light of these variables such as the accentuation of certain spectral lines of iron and magnesium. Some of these effects appear at so low a temperature that the furnace is very feebly luminous and long exposures are required. With this in mind it seems remarkable that we can photograph them at all in a distant star, but the immense size of the variables and the great depth of their atmospheres partly offset the weakening of the light by the great distances. In laboratory sources the thickness of the radiating gas is but a few centimeters, while in the variables it is thousands of kilometers. Thus it happens that certain conditions of low intrinsic luminosity may actually be easier to observe in astrophysical sources than in the laboratory. This is almost certainly true of the condition prevailing in extended nebulae, and is probably true also of the very low densities of the atmospheres of long-period variables. For example, if, as a purely physical problem, one desired to study the effects of extremely low density upon the radiation of atoms of various chemical elements, long-period variable stars might furnish data difficult or impossible to obtain in the laboratory.

Long-period variables probably have the lowest densities of all known stars. In extreme cases like χ Cygni the average density is of the order of one-millionth that of the sun, and the density near the outside where the spectrum lines are produced is probably far below that which has been studied spectroscopically in the laboratory.

The low densities of the stars have already taught us a good deal about atoms and radiation, and we have yet much more to learn from these gigantic low-density laboratories.

THE ECLIPSE OF JUNE 29, 1927.

The total solar eclipse which will occur on June 29 of this year is receiving more and more consideration as the time draws nearer. The path of totality crosses northern England, the North Sea, Norway, Sweden, and Lapland. It is the first total eclipse of the sun in the British Isles since 1724, and there will not be another until the year 1999. The eclipse will occur very early in the morning in England, the

sun being only about 12° above the horizon. For this reason Norway and Sweden will probably be favored by the specially planned eclipse expeditions, as here the sun will be higher, and the totality of slightly longer duration.

Miss Mary Proctor, who has been active in making arrangements for private parties in England, in a recent letter states that in her judgment Darlington is unsuited as an eclipse site and that Richmond, in Yorkshire, and Southport, on the west coast, are preferable.

Through the courtesy of Mr. H. W. Newton, secretary of the eclipse committee of the Royal Astronomical Society, we have received an advance copy of the eclipse notes to appear in the March issue of the *Journal of the R.A.S.* From this source we learn that a large contour map, 10 miles to 1 inch, showing the eclipse track has been prepared, and may be secured for three shillings by addressing Mr. H. W. Newton, 10, Caterham Road, S.E. 13. London. Besides marking the limits of totality, lines are also drawn showing the magnitude of the eclipse observable between London and the Clyde; the altitude of the sun and the time of mid-eclipse at any place can also be read off with ease. Preliminary steps have been taken to run a special train from London, leaving on the afternoon of June 26 and returning the next day, in case a sufficient number should wish such transportation.

From *Monthly Notices* for January we learn that the eclipse will be observed by parties from several of the observatories in England as follows:

1. A party at Giggleswick from the Royal Observatory.

2. A party at Hartlepool organized by Dr. Lockyer and Sir F. McClean.

3. A part at Southport organized by Professor Turner and Dr. H. Knox-Shaw.

4. A party at Stonyhurst under Father O'Connor.

5. An expedition to Al, in Norway, under Professor Newall.

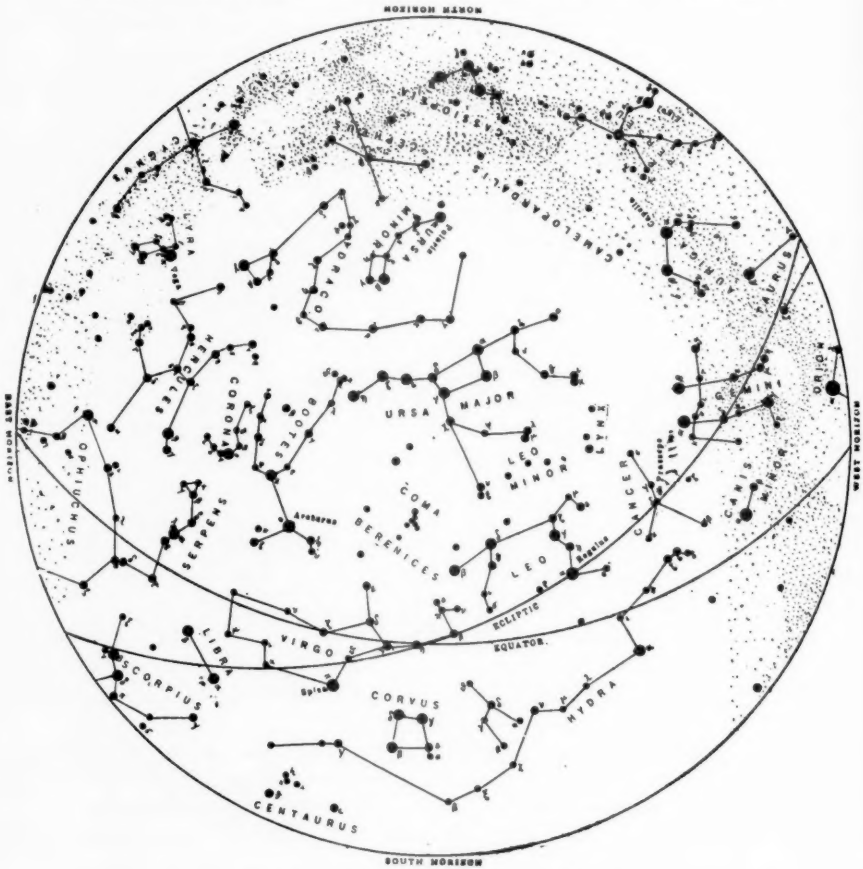
6. Professor Fowler will observe the very large partial eclipse with powerful spectroscopic apparatus at South Kensington, and Professor Sampson will also make special observations of the large partial eclipse at Edinburgh.

At the present time two expeditions, the McCormick-Chaloner Solar and an expedition under the direction of Dr. Harlan T. Stetson of Harvard, from the United States have been planned for some point in Norway. Other expeditions are under consideration but not definitely arranged.

PLANET NOTES FOR MAY.

By CLIFFORD E. SMITH.

The *Sun* will continue to move northeast during May, crossing from Aries into Taurus about May 15. At the end of the month it will be in a rich field in



THE CONSTELLATIONS AT 9:00 P.M. MAY 1.

Taurus about three degrees north of ε Tauri (roughly 6° north of Aldebaran). The position of the sun on May 1 will be R.A. $2^h\ 29^m$, Decl. $+14°\ 42'$; the position on May 31 will be R.A. $4^h\ 27^m$, Decl. $+21°\ 44'$.

The phases of the *Moon* for May will occur as follows:

New Moon	May	1 at	7 A.M.	C.S.T.
First Quarter		8 "	9 A.M.	"
Full Moon		16 "	1 P.M.	"
Last Quarter		23 "	12 P.M.	"

The moon will be at apogee (farthest from the earth) on May 12, and at perigee (nearest the earth) on May 28.

Mercury will be rather interesting during May because it will be a morning star, rising about an hour before the sun on May 1, and an evening star, setting about an hour after the sun on May 31. This will happen because both conjunction and perihelion occur near the middle of the month. Mercury will be at superior conjunction on May 20, and at perihelion on May 23. On May 31 Mercury will be less than three degrees south of β Tauri.

Venus will continue to move east from the sun, and it will cross over into Gemini early in the month. During the middle of the month it will set about three hours after the sun.

Mars will continue to move east in Gemini. At the end of the month it will be only about five degrees east of Venus.

Jupiter will be in Pisces, and it will be a morning object during May. It will rise about three and a half hours before the sun at the middle of the month.

Saturn will be in opposition on May 26. Thus it will be on the meridian at midnight on that date. Saturn will not be in a position favorable for observations in northern latitudes this year. Its altitude for latitude 44 degrees north can never be greater than 25 degrees. Saturn will be in Scorpio during May, a few degrees nearly due north of Antares.

Uranus will be in Pisces. Its right ascension will be about zero, thus it will rise about four hours before the sun at the end of the month.

Neptune will be in Leo about three degrees approximately west of α Leonis. It will be in quadrature on May 16.

COMET NOTES.

By G. VAN BIESBROECK.

Comet 1927 *c* (Periodic Comet Pons-Winnecke).

This month two new arrivals among the comets have taken the place of some of the fainter ones that are dropping out of sight. The first one was announced on March 3; it is the expected return of periodic comet Pons-Winnecke. It was found by the writer at the Yerkes Observatory on plates exposed in a position corresponding to the one indicated by the ephemeris given in the February number (p. 119) and based on the elements by C. J. Merfield.

Because the object was expected to be quite faint at that early date the exposures were arranged in such a way that the plate followed the known displacement of the unseen comet among the stars. The result is illustrated by Fig. 1, which is an enlargement of a pair of plates obtained on March 3 with the 24-inch reflector. The two exposures each lasted 40 minutes and were taken in immediate succession. The comet appears as a small round nebulosity about 10″ in diameter and its displacement from the first plate to the second corresponds to the length of the trails recorded by each star on the moving plate. The two plates were necessary in order to be certain that the minute speck of light was genuine and not caused by the inevitable tiny defects which are found on almost any plate. The diffuseness of the star-trails on the plate is due to the fact that the object

was situated about half a degree from the expected place, which was in the center of the plate. Further exposures on March 4 and 9 confirmed those of March 3 and knowing more exactly where to look for it I traced the comet back on plates taken Feb. 27, but it is extremely faint on the latter, about 17M. On March 3 the brightness was estimated at 16M.5. On March 9 it had brightened up to 16M.

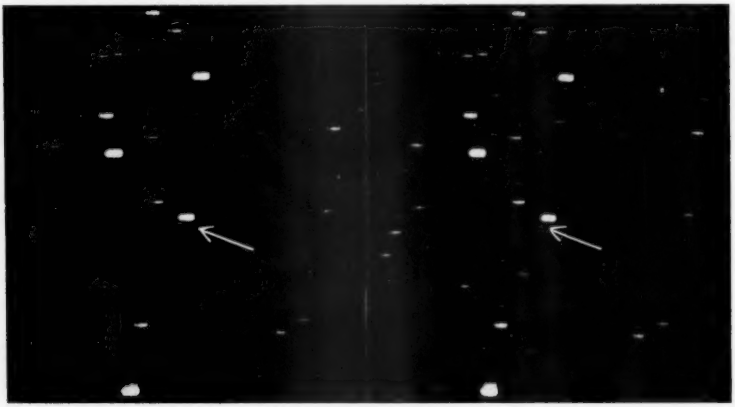


Figure 1.
COMET PONS-WINNECKE AT DISCOVERY, MARCH 3.

The positions obtained are as follows:

1927 U.T.	α h m s	δ ° ′ ″
Feb. 27.2604	14 6 58.69	+24 28 17.5
Mar. 3.4302	12 20.42	25 45 23.7
4.3082	13 24.72	26 2 29.5
9.3946	19 22.43	28 46 36.8

So far no other positions have been communicated.

The differences between the observations and the computed places indicate a retardation of 0.54 days in the computed time of perihelion, which therefore becomes June 21.1. The correction is quite small considering that the object has not been seen for six years. A rough computation shows that this retardation will make the closest approach to the earth at the end of June even nearer than was predicted, some 3½ instead of 4 million miles.

The following corrected ephemeris will be helpful in watching the approach of the comet. A more extended one will be given next month, when we will consider more in detail the circumstances of the June approach.

EPHEMERIS OF COMET PONS-WINNECKE.

0h U.T.	α h m	δ ° ′	Log. Δ	Log. r	Mag.
1927 Mar. 1	14 9.5	+24 57	9.988	0.247	16.5
9	19.1	27 35	.941	.229	15.8
17	27.8	30 32	.894	.211	15.1
25	35.6	33 45	.847	.191	14.3
Apr. 2	42.4	37 7	.800	.171	13.5
10	48.0	40 30	.753	.151	12.8
18	52.7	43 44	.705	.130	12.0
26	14 56.8	+46 41	9.656	0.110	11.2

The magnitudes given in the last column are rather hypothetical. They are adjusted so as to represent the brightness observed in the beginning of March of this return as well as the brightness at the time of discovery in 1921, which was called 12^M under circumstances corresponding to April 18 of this year.

COMET 1927 *d* (STEARNS).

The second comet announced since last month is an unexpected object found by C. L. Stearns at the Van Vleck Observatory, Middletown, Conn. It was found visually with the 20-inch refractor, in the course of the regular work on stellar parallaxes carried on at that observatory under the direction of Prof. F. Slocum. The comet had wandered into one of the parallax fields. The position at discovery puts it in the constellation of Libra:

	α	δ	
March 10.420	$15^h\,16^m\,6^s.4$	$-7°\,21'\,43''$	Magnitude 10.

From the daily motion, -15^s $+19'$, it appears that it moves slowly northwestward and therefore comes in better position for northern observers. The

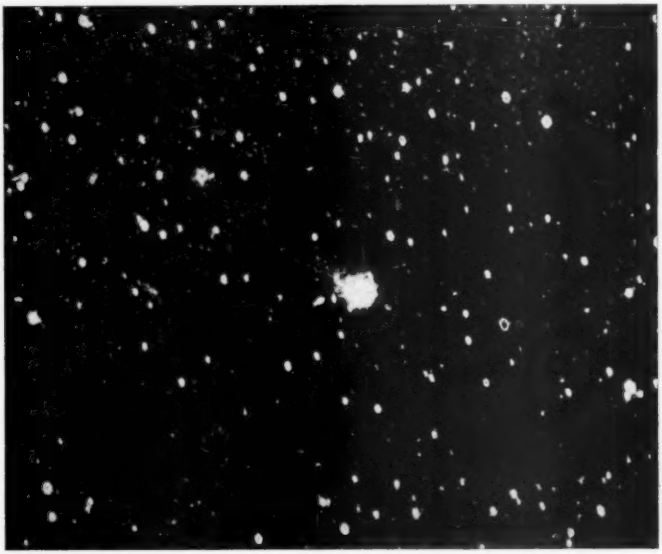


Figure 2.
COMET STEARNS (1927 *d*) MARCH 13.

telegraphic announcement was received here on March 12. That same night I secured several exposures with the 24-inch reflector. Plates exposed 20 seconds showed only the nucleus, the brightness of which was estimated as 11^M. The exposure being lengthened to 5 minutes, most of the nebulosity surrounding the nucleus made its impression so that the integrated brightness corresponds to $8^M.5$. An exposure of 24 minutes with guiding for the motion of the comet brought out a faint tail about 10′ in length in position-angle 215°. A reproduction of this plate has been tried (Fig. 2) after enlarging the original about four times and

intensifying it by recopying. Curiously enough on this plate the integrated light of the comet is fully as bright as a nearby star of 7^M. As another extreme L. E. Cunningham estimates the brightness as $12^M.5$ on Harvard plates. These are evidently short exposures and refer only to the nucleus.

The following positions have been circulated so far:

1927 U.T.	α h m s	δ ° ′ ″	Observer	Place
Mar. 13.41206	15 15 18.51	—6 24 56.5	Van Biesbroeck,	Yerkes Obsy.
14.0835	15 6.6	—6 11 54	Vinter-Hansen,	Copenhagen
15.1548	14 46.5	—5 51 26	G. Struve,	Babelsberg
15.30493	14 43.18	—5 48 3.2	Van Biesbroeck,	Yerkes Obsy.
Mar. 16.30735	15 14 21.87	—5 28 6.5	Van Biesbroeck,	Yerkes Obsy.

After obtaining the last of these positions, the same day I computed a preliminary parabolic orbit from the dates March 10, 13, and 16, but this was not sent out on account of the great uncertainty of the result. Another set was computed by L. E. Cunningham, (Harvard Announcement Card 23, March 18), and a third one by H. Thiele at Berkeley, communicated by Prof. Leuschner through the air-mail under date March 19, has just been received here:

PARABOLIC ELEMENTS OF COMET STEARNS.

	Computer		
	G. Van Biesbroeck	L. E. Cunningham	H. Thiele
T Perihelion (U.T.)	1927 April 23.892	1927 Sept. 6.2	1927 Mar. 18.310
ω Node to perihelion	17° 30′.1	48° 59′	10° 16′.2
☊ Ascending Node	214 44.8	214 54	214 33.9
i Inclination	88 21.1	92 29	87 16.5
q Perihelion distance	3.667	3.192	3.684

The motion being slow and the distance unusually large the elements are still quite undetermined, especially ω and T which are interdependent. From the first set of elements I have deduced the following ephemeris for April:

0^h U.T.	α h m s	δ ° ′	Log. r	Log. Δ	Mag.
1927 April 1	15 6 16	+ 0 8.3	0.565	0.451	10.0
5	3 26	1 40.2			
9	15 0 20	3 12.9	0.565	0.442	10.0
13	14 56 59	4 46.2			
17	53 26	6 19.2	0.564	0.436	9.9
21	49 41	7 50.8			
25	45 51	9 21.6			
29	14 41 55	+10 51.1	0.564	0.436	9.9

The comet is moving slowly northward in Boötes and will pass near Arcturus in May.

The distances change so little that there is hardly any increase in brightness. It is surprising that at such a large distance from the sun the comet would manifest enough activity for developing a tail. The angular extent under which we see it on the plate would correspond to a length of one million miles, not taking into account the perspective foreshortening which most likely has reduced it appreciably.

Of the other comets of the season three are no longer in reach of our equipment:

PERIODIC COMET 1926 *e* (GIACOBINI-ZINNER) was last recorded on March 4. It is too faint (below 15^M) for further observations. The object has been followed during five months at this return.

The last observation of COMET 1925 *a* (SHAJN-COMAS SOLÁ) was obtained

here on the same night. It is doubtful if it will be followed later in other places. Its magnitude was hardly 16th on that last date and furthermore it is moving too far into the western sky. It has been watched for nearly two years from the date of its discovery 1925 March 22.

Periodic Comet 1926 *g* (Neujmin) has been observed here as far south as —35° on March 9, when its brightness had dropped below 14M. In the first days of February it was fully as bright as 12M. The theoretical brightness in March and April is about constant. The rapid drop in March will probably set an early end to the observations in the southern hemisphere. So far the visibility has lasted four months.

Comet 1926 *f* (Comas Solá) is still well placed in the evening sky. It follows well Crommelin's ephemeris given last month (p. 175). However, its observation requires a large telescope because the total brightness is not greater than 13M.5. The tail is still faintly visible (March 3) and there is a good nucleus which makes accurate measures possible even on a moonlit sky (March 17).

No further information has been received about the two southern comets 1927 *a* (Blathwayt) and 1927 *b** (Reid).

Several attempts to locate the latter one in the evening sky in the beginning of March have been unsuccessful. It seems evident that it is now not as bright as predicted by the ephemeris given last month (p. 174).

Vain efforts have also been made here in locating the expected periodic comet Grigg-Skjellerup (see ephemeris p. 175). Unless the predicted position is more in error than anticipated the comet is evidently quite faint yet.

Williams Bay, Wisconsin, March 22, 1927.

METEOR NOTES.

By CHARLES P. OLIVIER.

With the coming of April the relative inactivity of meteors begins to be changed and in the last half and the beginning of May we have two very good showers, the Lyrids and the Eta Aquarids. The abundance of the Lyrids changes enormously for different years. There was a wonderful shower of them in 1803 and a good shower in 1922, but on the whole their activity has been greater during the past five years than for some time previously. They seem to follow the orbit of Comet 1861 I. Some Lyrids may usually be seen from about April 17 to 23, with a probable maximum on April 21. Moonlight, unfortunately, will interfere somewhat in 1927.

The Eta Aquarids, which follow orbits nearly the same as that of Halley's Comet and are connected therewith, are seen for the first ten days of May. For observers in the United States the radiant rises in the southeast, and only for the three hours before dawn can these meteors be seen. Nevertheless, due to the importance of Halley's Comet, and the fact that the stream has many points of interest, all meteor observers should concentrate upon it. For this return, also, the moon will be entirely out of the way. The maximum will probably occur May 4.

In the February Meteor Notes it was said that 24 reports of brilliant meteors seen in 1926 had been received from the U. S. Weather Bureau and the Hydro-

*Note: Erroneously printed *c* on p. 173.

graphic Office, U. S. N. Reports for the last part of 1926, since received, raise this number to 36. It is also gratifying that several officers upon different ships have written for meteor maps and instructions, with a view to more regular work along the lines followed by observers of the American Meteor Society.

A very brilliant fireball crossed part of North Carolina on February 27, 1927, at about 9 P.M. The writer is now attempting to secure enough data to compute its heights and orbit. If any reader happened to see this fireball, he is urgently requested to send in his observations. Several very good reports have already come, but for the sake of accuracy as many as possible are needed. This body seems to have moved in general from west to east, to have been nearly or quite as bright as the full moon, and to have exploded a considerable distance above the ground. The hope of finding fragments is therefore small.

It may now be assumed that all reports of the A.M.S. for 1926 have arrived. Our observers are nearly unanimous in saying that much cloudy weather, particularly at the critical epochs of the principal showers, made 1926 one of the worst years for meteor observing on record. This makes it all the more desirable that more than usual should be done in 1927 to make up for the bad fortune of last year.

VARIABLE STARS.

Long Period Variables.

PREDICTED MAXIMA AND MINIMA.

In *Harvard College Observatory Circular* 297 are given the dates in 1927 when certain long period variables come to maximum or minimum phase. We have selected from this list those which occur in May. The columns are self explanatory except possibly the third. In this column the number denotes the day of the month (May), "M" denotes maximum phase, and "m," minimum phase. Those which are too near the sun to be observed are omitted.

Des.	Name	Day and Phase	Des.	Name	Day and Phase	Des.	Name	Day and Phase
001909	S CET	29M	*133633*	T CEN	12m	*190819a*	RW SGR	29m
002438a	T SCL	16M	144918	U BOO	19m	*191319a*	S SGR	1M
002546	T PHE	19M	*150018*	RT LIB	3m	*193972*	T PAV	13M
003179	Y CEP	20m	*150605*	Y LIB	4M	194348	TU CYG	9M
004132	RW AND	4M	*151520*	S LIB	9m	*195142*	RU SGR	1m
010102	Z CET	23M	*153020*	X LIB	9M	*195202*	RR AQL	29m
013238	RU AND	19M	154536	X CR*B*	15m	*200715a*	S AQL	17m
015254	U PER	23M	*160021*	Z SCO	2m	201130	SX CYG	16m
015912	S ARI	**7M**	*160221a*	X SCO	1m	*202240*	U MIC	**7m**
053068	S CAM	27M	160325	SX HER	17m	*203429*	R MIC	15M
055353	Z AUR	26M	*160519*	W SCO	26M	203847	V CYG	17M
072811	T CMI	1m	*161122a*	R SCO	4M	204016	T DEL	31M
073508	U CMI	29M	*161122b*	S SCO	19m	204846	RZ CYG	9m
073723	S GEM	5m	161138	W CRB	15m	*204954*	S IND	25M
074241	W PUP	6m	163137	W HER	19m	*210221*	X CAP	25M
083350	X UMA	28M	163266	R DRA	13M	*210516*	Z CAP	16m
092962	R CAR	31M	170627	RT HER	19m	*210903*	RR AQR	31m
093014	X HYA	13m	175111	RT OPH	26m	213678	S CEP	5m
104628	RS HYA	21M	175458a	T DRA	19M	215934	RT PEG	16m
104814	W LEO	31M	180531	T HER	11M	*221938*	T GRU	23M
110506	S LEO	7M	181136	W LYR	5M	*225120*	S AQR	7M
111661	RS CEN	31M	*182133*	RV SGR	9m	230110	R PEG	29M
115919	R COM	25M	182224	SV HER	9m	230759	V CAS	30m
122532	T CVN	29M	182306	T SER	16m	232746	V PHE	11m
123459	RS UMA	9M	184074	RS DRA	5m	*233815*	R AQR	5M
124606	U VIR	13m	184134	RY LYR	3m	235939	SV AND	11m
132706	S VIR	26M	*184205*	R SCT	21m			

Minima of Variable Stars of Short Period.

[Calculated by members of the classes in Astronomy at Carleton College.]

Given to the nearest hour in Greenwich civil time; to obtain Eastern Standard time subtract 5^h; Central Standard time 6^h, etc.

Star	R.A 1900	Decl. 1900	Magnitude	Approx. Period	Greenwich civil times of Minima in 1927							
					May							
	h m	° ′		d h	d h		d h		d h		d h	
SY Androm.	0 08.0	+43 09	9.5—13.0	34 21.8					22 1			
RT Sculptor.	31.5	—26 13	9.6—10.5	0 12.3	8 10		16 2		23 18		31 10	
U Cephei	0 53.4	+81 20	7.0— 9.0	2 11.8	6 0		13 11		20 22		27 10	
Z Persei	2 33.7	+41 46	9.4—12	3 01.4	1 5		13 10		19 13		31 18	
TW Cassiop.	37.6	+65 19	8.2— 9.0	1 10.3	3 17		12 6		20 20		29 10	
RY Persei	39.0	+47 43	8.0—10.3	6 20.7	2 5		9 1		15 22		22 19	
RZ Cassiop.	39.9	+69 13	6.9— 8.1	1 04.7	3 8		10 12		17 16		24 20	
TX Cassiop.	44.4	+62 22	9.4—10.1	2 22.2	8 12				17 8		26 2	
ST Persei	53.7	+38 47	8.5—10.5	2 15.6	2 3		10 1		18 0		25 23	
RX Cassiop.	2 58.8	+67 11	8.6— 9.1	32 07.6	6 18							
Algol	3 01.7	+40 34	2.3— 3.5	2 20.8	7 18				16 8		24 23	
RT Persei	16.7	+46 12	9.5—11.5	0 20.4	3 2		9 20		23 11		30 6	
λ Tauri	55.1	+12 12	3.3— 4.2	3 22.9	8 16		16 13				24 11	
RW Tauri	3 57.8	+27 51	7.1— [11	2 18.5	9 0				17 7		25 15	
RV Persei	4 04.2	+33 59	9.5—11.0	1 23.4	7 9		15 6		23 4		31 1	
RW Persei	13.3	+42 04	8.8—11.0	13 04.8	6 19				20 0			
SZ Tauri	31.4	+18 20	7.2— 7.7	3 03.6	4 16		10 23		23 14		29 21	
RS Cephei	4 48.6	+80 06	9.5—12.0	12 10.1	2 2		14 12				26 22	
TT Aurigae	5 02.8	+39 27	7.8— 8.7	0 16.0	5 8		11 23		25 7		31 23	
RY Aurigae	11.5	+38 13	10.7—11.7	2 17.5	8 11		16 11		24 15			
RZ Aurigae	42.9	+31 40	10.6—13.3	3 00.3	3 9		9 9		21 11		27 11	
SV Tauri	45.8	+28 05	9.4—11.0	2 04.0	1 12		10 4		18 20		27 12	
Z Orionis	50.2	+13 40	9.7—10.7	5 04.9	2 17		13 3		23 12			
SV Gemin.	54.6	+24 28	9.8— [11	4 00.2	7 13		15 13		23 13		31 14	
RW Gemin.	5 55.4	+23 08	9.5—11.0	2 20.8	1 17		13 4		18 22		30 9	
U Columbæ	6 11.2	—33 03	9.2—10.0	2 19.2	2 12		13 17		19 8		30 12	
SX Gemin.	22.0	+20 37	10.8—11.5	1 08.8	6 23		15 4		23 8		31 13	
RW Monoc.	29.3	+ 8 54	9.0—10.8	1 21.7	7 5		14 20		22 11		30 2	
RX Gemin.	43.6	+33 21	8.8— 9.6	12 05.0	1 17		13 22				26 3	
RU Monoc.	6 49.4	— 7 28	9.8—10.5	0 21.5	6 10		13 14		20 18		27 22	
R Can. Maj.	7 14.9	—16 12	5.8— 6.4	1 03.3	6 8		13 3		19 23		26 18	
RY Gemin.	21.7	+15 52	8.9— [10	9 07.2	8 19				18 2		27 10	
Y Camelop.	27.6	+76 17	9.5—12	3 07.3	6 5		12 20		19 10		26 1	
TX Gemin.	30.3	+17 08	10.0—11.9	2 19.2	5 15		14 1		22 11		30 20	
RR Puppis	43.5	—41 08	9.4—10.7	6 10.3	6 22		13 8		19 18		26 5	
V Puppis	7 55.4	—48 58	4.1— 4.8	1 10.9	5 16		12 23		20 6		27 12	
X Carinæ	8 29.1	—58 53	7.9— 8.7	0 13.0	7 23		16 1				24 4	
S Cancri	8 38.2	+19 24	8.2—10	9 11.6	5 14		15 2				24 14	
RX Hydræ	9 00.8	— 7 52	9.1—10.5	2 06.8	7 14		14 10		21 6		28 3	
S Velorum	29.4	—44 46	7.8— 9.3	5 22.4	6 21		12 19		24 16		30 14	
Y Leonis	9 31.1	+26 41	9.3—11.2	1 16.5	7 9		14 3		20 21		27 15	
RR Velorum	10 17.8	—41 36	10.0—10.9	1 20.5	7 20		15 6		22 16		30 2	
SS Carinæ	10 54.2	—61 23	12.2—12.8	3 07.2	6 8		12 23		19 13		26 3	
ST Urs. Maj.	11 22.4	+45 44	6.7— 7.2	8 19.2	4 12		13 8		22 3		30 22	
RW Urs. Maj.	35.4	+52 34	10.3—11.4	7 07.9	3 13		10 21		18 5		25 12	
Z Draconis	11 39.8	+72 49	9.9—13.6	1 08.6	5 13		12 8		19 3		25 22	
RZ Centauri	12 55.6	—64 05	8.5— 8.9	1 21.0	3 6		10 18		18 6		25 19	
RS Can. Ven.	13 06.3	+36 28	7.5—12.5	4 19.1	8 16				18 6		27 21	
SS Centauri	07.2	—63 37	8.8—10.4	2 11.5	3 12		10 22		18 8		25 19	

Minima of Variable Stars of Short Period—Continued.

Star	R.A. 1900	Decl. 1900	Magnitude	Approx. Period	Greenwich civil times of Minima in 1927							
					May							
	h m	° ′		d h	d h	d h	d h	d h	d h	d h	d h	d h
SX Hydræ	13 39.0	−26 23	8.6—12.7	2 21.5	6 5	14 22					23	14
δ Libræ	14 55.6	− 8 07	4.8— 6.2	2 07.9	2 7	9 7	23	6			30	5
U Coronæ	15 14.1	+32 01	7.6— 8.7	3 10.9	5 5	12 2	18	23			25	22
TW Draconis	15 32.4	+64 14	7.3— 8.9	2 19.4	4 12	12 23	21	9			29	19
SS Libræ	15 43.4	−15 14	9.3—11.5	0 18.4	3 7	10 12	17	16			24	21
SW Ophiuchi	16 11.1	− 6 44	9.2—10.0	2 10.7	1 19	9 3	16	11			23	19
SX Ophiuchi	12.6	− 6 25	10.5—11.2	2 01.5	5 12	13 19	22	0			30	7
R Aræ	31.1	−56 48	6.8— 7.9	4 10.2	7 20	16 16					25	12
TT Herculis	16 49.9	+17 00	8.9— 9.3	20 18.1	1 19		22	13				
TU Herculis	17 09.8	+30 50	9.5—12	2 06.4	4 6	11 1	17	21			24	16
U Ophiuchi	11.5	+ 1 19	6.0— 6.7	1 16.2	5 16	14 1	22	10			30	19
μ Herculis	13.6	+33 12	4.6— 5.4	2 01.2	2 12	8 16	20	23			27	3
TX Herculis	15.4	+42 00	8.3— 9.0	2 01.4	2 2	8 6	20	15			26	19
RV Ophiuchi	29.8	+ 7 19	9. —12	3 16.5	7 4	14 13	21	22			29	7
SZ Herculis	36.0	+33 01	9.5—10.3	0 19.6	7 19	16 0					24	4
TX Scorpii	48.6	−34 13	7.5— 8.2	0 22.6	8 2	15 15	23	4			30	17
UX Herculis	49.7	+16 57	8.8—10.5	1 13.2	2 16	10 10	18	4			25	21
Z Herculis	53.6	+15 09	7.1— 7.9	3 23.8	4 8	12 8	20	7			28	7
WX Sagittarii	53.6	−17 24	9.2—10.8	2 03.1	5 17	14 5	22	18			31	6
WY Sagittarii	17 54.9	−23 01	9.5—10.6	4 16.0	1 19	11 4	15	20			25	4
SX Draconis	18 03.0	+58 23	9.3—10.5	5 04.1	4 23	15 7	20	11			30	19
RS Sagittarii	11.0	−34 08	5.9— 6.3	2 10.0	6 17	13 22	21	4			28	10
V Serpentis	11.1	−15 34	9.5—11.1	3 10.9	4 2	12 0	24	20			31	18
RZ Scuti	21.1	− 9 15	7.4— 8.3	15 03.2		10 18					25	21
RZ Draconis	21.8	+58 50	9.5—10.2	0 13.2	2 5	9 9	23	16			30	20
RX Herculis	26.0	+12 32	7.0— 7.6	0 21.3	9 0	15 3	22	6			29	9
SX Sagittarii	39.7	−30 36	8.7— 9.8	2 01.8	1 3	9 11	17	18			26	2
RR Draconis	40.8	+62 34	9.3—13	2 19.9	1 9	9 21	18	9			26	21
RS Scuti	43.7	−10 21	9.3—10.3	0 15.9	4 0	10 15	23	22			30	13
β Lyræ	46.4	+33 15	3.4— 4.1	12 21.8		12 19					25	17
U Scuti	18 48.9	−12 44	9.1— 9.6	0 22.9	4 4	11 19	19	11			27	2
RX Draconis	19 01.1	+58 35	9.3—10.2	1 21.4	2 16	10 6	17	20			25	9
RV Lyræ	12.5	+32 15	11. —12.8	3 14.4	8 0	15 5	22	10			29	15
RS Vulpec.	13.4	+22 16	6.9— 8.0	4 11.4	3 4	12 3	21	2			30	1
U Sagittæ	14.4	+19 26	6.5— 9.0	3 09.1	3 8	10 2	23	14			30	9
Z Vulpec.	17.5	+25 23	7.3— 8.5	2 10.9	6 8	13 17	21	2			28	10
TT Lyræ	24.3	+41 30	9.4—11.6	5 05.8	2 12	12 23	18	5			28	17
UZ Draconis	26.1	+68 44	9.0— 9.8	1 15.1	7 1	13 11	20	2			26	15
SY Cygni	19 42.7	+32 28	10. —12	6 00.2	3 17	9 18	21	18			27	18
WW Cygni	20 00.6	+41 18	9.3—13.4	3 07.6	6 8	12 23	19	14			26	6
SW Cygni	03.8	+46 01	9. —11.7	4 13.8	2 6	11 9	20	13			29	16
VW Cygni	11.4	+34 12	9.8—11.8	8 10.3	6 1	14 12	22	22			31	8
RW Capric.	12.2	−17 59	8.8—10.6	3 09.4	2 13	9 8	22	21			29	16
UW Cygni	19.6	+42 55	10.5—13	3 10.8	3 17	10 15	24	10			31	8
V Vulpec.	32.3	+26 15	8.2— 9.8	37 19.0							27	0
W Delphini	33.1	+17 56	9.4—12.1	4 19.4	2 12	12 2	21	17			31	8
RR Delphini	38.9	+13 35	10.5—11.8	4 14.4	4 0	13 5	22	9			31	14
Y Cygni	48.1	+34 17	7.1— 7.9	2 23.9	3 19	12 19	21	18			30	18
WZ Cygni	49.3	+38 27	9.9—10.8	0 14.0	6 22	14 13	22	3			29	17
RR Vulpec.	20 50.5	+27 32	9.6—11.0	5 01.2	4 5	14 7					24	10
RY Aquarii	21 14.8	−11 14	8.8—10.4	1 23.2	3 21	11 18	19	15			27	11
UZ Cygni	55.2	+43 52	8.9—11.6	31 07.3		9 14						
RT Lacertæ	21 57.4	+43 24	9.1—10.5	5 01.7	3 20	13 23	19	1			29	5
RW Lacertæ	22 40.6	+49 08	10.2—11.2	5 04.4	3 5	13 13	18	18			29	3
VW Pegasi	51.7	+32 42	10.0—10.6	5 06.4	5 18	11 1	21	14			26	20
Y Piscium	23 29.3	+ 7 22	9.0—12.0	3 18.4	1 15	9 3	24	5			31	18
TW Androm.	23 58.2	+32 17	8.6—11.5	4 02.9	6 16	14 22	23	4			31	10

Maxima of Variable Stars of Short Period.

[Calculated by members of the classes in Astronomy at Carleton College.]

Given to the nearest hour in Greenwich civil time; to obtain Eastern Standard time subtract 5^h; Central Standard time 6^h, etc.

Star	R.A. 1900	Decl. 1900	Magnitude	Approx. Period	Greenwich civil times of maxima in 1927							
									May			
	h m	° ′		d h	d h	d h	d h	d h	d h	d h	d h	d h
SX Cassiop.	0 05.5	+54 20	8.6— 9.2	36 13.7	6 3							
SY Cassiop.	0 09.8	+57 52	9.3— 9.9	4 01.7	2 18	10 22	19 1	27 5				
RR Ceti	1 27.0	+ 0 50	8.3— 9.0	0 13.3	2 4	9 22	17 16	25 10				
RW Cassiop.	1 30.7	+57 15	8.9—11.0	14 19.2		9 15		24 10				
V Arietis	2 09.6	+11 46	8.3— 9.0	0 23.8	5 14	13 12	21 11	29 9				
SU Cassiop.	2 43.0	+68 28	6.5— 7.0	1 22.8	6 15	14 10	22 5	30 1				
RW Camelop.	3 46.2	+58 21	8.2— 9.4	16 00.0	8 4		24 14					
SX Persei	4 10.2	+41 27	10.4—11.2	4 07.0	9 9		17 23	26 13				
SV Persei	42.8	+42 07	8.8— 9.6	11 03.1	8 5		19 8	30 11				
RX Aurigæ	4 54.5	+39 49	7.2— 8.1	11 15.0		11 19		23 10				
SX Aurigæ	5 04.6	+42 02	8.0— 8.7	1 12.8	6 17	14 9	22 1	29 17				
SY Aurigæ	05.5	+42 41	8.4— 9.5	10 03.3		10 2	20 6	30 9				
Y Aurigæ	21.5	+42 21	8.6— 9.6	3 20.6	6 20	14 13	22 6	30 0				
RZ Gemin.	5 56.6	+22 15	9.1—10.0	5 12.7	3 10	14 12	20 1	**31 2**				
RS Orionis	6 16.5	+14 44	8.2— 8.9	7 13.6	8 8	15 22	23 11	31 1				
T Monoc.	19.8	+ 7 08	5.7— 6.8	27 00.3	2 12			29 12				
RT Aurigæ	23.0	+30 33	5.1— 6.0	3 17.5	1 21	9 8	24 6	31 17				
W Gemin.	29.2	+15 24	6.7— 7.5	7 22.0	5 7	13 5	21 3	29 1				
ζ Gemin.	6 58.2	+20 43	3.7— 4.3	10 03.7	5 13	15 17		25 21				
RU Camelop.	7 10.9	+69 51	8.5— 9.8	22 06.5		13 3						
RR Gemin.	7 15.2	+31 04	10.0—11.5	0 09.5	6 21	14 20	22 18	30 17				
V Carinæ	8 26.7	—59 47	7.4— 8.1	6 16.7	1 23	8 16	22 2	28 18				
T Velorum	8 34.4	—47 01	7.6— 8.5	4 15.3	1 5	10 12	19 18	29 1				
V Velorum	9 19.2	—55 32	7.5— 8.2	4 08.9	4 7	13 0	21 18	30 12				
Z Leonis	9 46.4	+27 22	7.9— 9.6	56 08.7								
RR Leonis	10 02.1	+24 29	9.1—10.1	0 10.9	2 15	9 10	23 0	29 19				
SU Draconis	11 32.2	+67 53	8.9— 9.6	0 15.8	4 11	11 2	24 7	30 21				
S Muscæ	12 07.4	—69 36	6.4— 7.3	9 15.8	4 8	14 1	23 16					
SW Draconis	12.8	+70 04	8.8— 9.6	0 13.7	8 13	16 13	24 12					
T Crucis	15.9	—61 44	6.8— 7.6	6 17.6	4 23	11 16	25 3	31 21				
R Crucis	18.1	—61 04	6.8— 7.9	5 19.8	4 20	10 17	22 8	28 4				
S Crucis	12 48.4	—57 53	6.5— 7.6	4 16.6	1 20	11 5	20 14	29 23				
W Virginis	13 20.9	— 2 52	8.7—10.4	17 06.5	4 18		22 1					
SS Hydræ	25.0	—23 08	7.4— 8.1	8 04.8	4 8	12 12	20 17	28 22				
RV Urs. Maj.	13 29.4	+54 31	9.2— 9.9	0 11.2	1 4	8 4	22 5	29 6				
ST Virginis	14 22.5	— 0 27	10.3—11.4	0 09.9	3 11	10 21	18 7	25 16				
V Centauri	25.4	—56 27	6.4— 7.8	5 11.9	2 1	13 1	18 12	29 12				
RS Bootis	29.3	+32 11	8.9—10.0	0 09.1	5 5	12 19	20 8	27 21				
R Trian.Austr.	15 10.8	—66 08	6.7— 7.4	3 09.3	6 0	12 18	19 13	26 7				
S Trian.Austr.	15 52.2	—63 29	6.4— 7.4	6 07.8	7 2	13 10	19 18	26 1				
S Normæ	16 10.6	—57 39	6.6— 7.6	9 18.1	5 18	15 12	25 6					
RW Draconis	33.7	+58 03	9.6—10.8	0 10.6	7 14	16 11	25 7					
RV Scorpii	16 51.8	—33 27	6.7— 7.4	6 01.5	3 22	10 0	22 2	28 4				
X Sagittarii	17 41.3	—27 48	4.4— 5.0	7 00.3	4 7	11 7	18 7	25 8				
Y Ophiuchi	47.3	— 6 07	6.1— 6.5	17 02.9		9 19		26 22				
W Sagittarii	17 58.6	—29 35	4.3— 5.1	7 14.3	2 9	10 0	17 14	25 4				
Y Sagittarii	18 15.5	—18 54	5.4— 6.2	5 18.6	6 11	12 6	23 19	29 13				
U Sagittarii	26.0	—19 12	6.5— 7.3	6 17.9	4 14	11 8	24 20	31 14				
Y Scuti	32.6	— 8 27	8.7— 9.2	10 08.3	8 6		18 14	28 23				
RZ Lyræ	39.9	+32 42	9.9—11.2	0 12.3	6 20	14 12	22 4	29 20				
RT Scuti	18 44.1	—10 30	9.1— 9.7	0 11.9	7 1	14 12	21 22	29 9				
κ Pavonis	18 46.6	—67 22	3.8— 5.2	9 02.2	2 11	11 13	20 16	29 18				
U Aquilæ	19 24.0	— 7 15	6.2— 6.9	7 00.6	3 6	11 6	18 7	25 7				
XZ Cygni	19 30.4	+56 10	8.6— 9.3	0 11.2	2 3	9 3	23 3	30 3				

Maxima of Variable Stars of Short Period—Continued.

Star	R.A. 1900	Decl. 1900	Magnitude	Approx. Period	Greenwich civil times of maxima in 1927 May							
	h m	° ′		d h	d h	d h	d h	d h	d h	d h	d h	d h
U Vulpec.	32.2	+20 07	6.5— 7.6	7 23.5	4 17	12 16	20 16	28 15				
SU Cygni	40.8	+29 01	6.2— 7.0	3 20.3	8 12	16 4	23 21	31 13				
η Aquilæ	47.4	+ 0 45	3.7— 4.5	7 04.2	2 20	10 0	24 8	31 13				
S Sagittæ	51.5	+16 22	5.6— 6.4	8 09.2	8 9	16 18	25 3					
X Vulpec.	19 53.3	+26 17	9.5—10.5	6 07.7	2 3	8 11	21 2	27 10				
X Cygni	20 39.5	+35 14	6.0— 7.0	16 09.3	2 15		19 0					
T Vulpec.	47.2	+27 52	5.5— 6.1	4 10.5	4 18	13 15	22 12	31 9				
UY Cygni	52.3	+30 03	9.6—10.4	0 13.5	7 12	14 19	22 2	29 9				
RV Capric.	55.9	—15 37	9.2—10.1	0 10.7	4 9	11 13	18 17	25 21				
TX Cygni	20 56.4	+42 12	8.5— 9.7	14 17.4		12 6		26 23				
VY Cygni	21 00.4	+39 34	8.8— 9.5	7 20.6	7 19	15 15	23 12	31 9				
SW Aquarii	10.2	— 0 20	9.9—10.8	0 11.0	6 19	13 16	20 14	27 11				
VZ Cygni	21 47.7	+42 40	8.2— 9.2	4 20.7		9 0	18 17	28 11				
Y Lacertæ	22 05.2	+50 33	9.1— 9.6	4 07.8	3 1	11 17	20 8	29 0				
δ Cephei	25.5	+57 54	3.7— 4.6	5 08.8	4 10	15 4	20 12	31 6				
Z Lacertæ	36.9	+56 18	8.2— 9.0	10 21.1		9 12	20 10	31 7				
RR Lacertæ	37.5	+55 55	8.5— 9.2	6 10.1	5 20	12 6	25 2	31 12				
V Lacertæ	44.5	+55 48	8.5— 9.5	4 23.6	3 10	13 9	23 8					
X Lacertæ	22 45.0	+55 54	8.2— 8.6	5 10.7	3 22	14 20	20 6	31 4				
SW Cassiop.	23 03.7	+58 11	9.2— 9.7	5 10.6	5 20	11 6	22 3	27 14				
RS Cassiop.	32.6	+61 52	9.0—11.0	6 07.1	1 17	8 0	20 14	26 22				
RY Cassiop.	47.2	+58 11	9.3—11.8	12 03.4		11 16		23 19				
V Cephei	23 51.7	+82 38	6.0— 7.0	0 23.9	7 22	14 22	21 21	28 21				

Monthly Report of the American Association of Variable Star Observers, for the Month ending February 28, 1927.

It is worthy of note that we have forty-three contributors to this report, a twenty-five percent increase over that for any month for several years past. Particular attention is called to the maiden lists received from Messrs. Recht, Greenberg, Kukarkin and Bostchev, and Misses Gushee and Hollister. All deserve our commendation.

Once again we are confronted with the loss of another of our members, Mr. Richard S. Chisolm, of New York. He will be recalled as the editor of our Northampton meeting last spring, whose account of that delightful occasion appeared as number 9 of Variable Comments. Mr. Chisolm, lawyer, manufacturer, and real estate manager, died, a victim of pneumonia, early in February. He had indicated a keen interest in our organization and was looking forward to the time in the not too distant future when he could relinquish the cares of business and devote more of his energies to variable star observing.

SS Aurigae was again at maximum on February 24, as announced from the McCormick Observatory. U Geminorum was at maximum late in January and should be closely observed again in May for its next rise.

The following observers have contributed to the results here presented: Miss Allen, "Ae"; Messrs. Allen, "Al"; Baldwin, "Bl"; Bappu, "Bf"; Barnes, "Bx"; Berman, "Bi"; Bhaskaran, "Bg"; Bostchev, "Bc"; Bouton, "B"; Brown, "Bn"; Chandra, "Ch"; Chandler, "Cd"; Cherrington, "Cb"; Clement, "Cl"; Cunningham, "Cu"; Ebert, "Eb"; Ensor, "En"; Gaebler, "Gb"; Goodsell, "Gs"; Gomi, "Go"; Greenberg, "Gg"; Miss Gushee, "Gu"; Mr. Hama, "H"; Miss Hollister,

Variable Star Observations Received During February, 1927.

Dec. 0 = J. D. 2424850; Jan. 0 = J. D. 2424881; Feb. 0 = J. D. 2424912.

J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.
V Scl			T Cet			T Phe			U Tuc			R Psc			R Ari		
000339			*001620*			*002546*			*005475*			012502			021024		
852[	13.3	Bl	879	5.9	Kd	876[	13.6	Bl	880	10.0	En	905	7.9	Pt	910	10.4	Wk
876	14.0	Bl	882	6.0	L	881[	13.0	Sm	881	10.3	Sm	922	7.7	Lv	910	9.9	B
S Scl			885	6.0	Kd	W Scl			Z Cet			924	8.0	Bx	914	10.4	Ie
001032			899	6.0	Kd	*002833*			*010102*			924	7.8	Kz	915	10.4	Wk
818	7.1	Kd	901	6.1	Kd	852	13.0	Bl	905	12.5	Pt	924	7.9	Eb	922	10.9	Lv
820	6.9	Kd	908	6.1	Kd	876	13 0	Bl	U Scl			RU And			W And		
828	6.9	Kd	911	6.1	Kd	U Cas			*010630*			013238			021143a		
843	6.9	Kd	T And			004047			852	14.0	Bl	885[	11.5	Ch	883	11.0	Ch
845	6.9	Kd	001726			904	11.8	Sg	876[	13.2	Bl	905	12.8	Pt	889	9.6	Hu
846	7.0	Kd	885	10.0	Ch	905	11.6	Bi	U And			Y And			905	8.0	Pt
847	6.9	Kd	904	10.9	Wk	905	11.5	Pt	010940			013338			910	8.6	Eb
851	7.2	Kd	905	11.0	Bi	914	11.1	Rh	902	11.6	B	885[	11.4	Ch	910	8.6	Kz
853	7.1	Kd	908	11.0	Cu	916	11.0	Rh	914	10.5	Rh	905	14.0	Pt	914	8.1	Ie
853	6.9	Sm	910	10.6	Wk	916	11.1	Ie	916	11.0	Rh	915[	13.3	B	914	7.7	B
859	7.2	Kd	915	10.6	Wk	919	11.5	Cl	916	10.3	Ie	X Cas			924	8.0	Bx
862	7.5	Ht	915	10.8	B	922	10.8	Lv	UZ And			014958			924	6.8	Kz
862	6.5	Bl	916	10.9	Ie	923	10.0	B	011041			905	10.0	Pt	924	8.1	Eb
863	7.0	Sm	919	10.3	Cl	RW And			924[	10.2	Kz	914	10.2	B	T Per		
865	7.5	Ht	920	10.5	Wk	004132			S Psc			914	10.7	Bn	021258		
870	7.3	Bl	T Cas			885[	11.0	Ch	011208			RR Ari			886	9.1	Ch
871	7.6	Kd	001755			V And			915	8.8	B	015023			889	8.4	Hu
872	7.5	Kd	886	8.9	L	004435			S Cas			820	6.0	H	905	8.7	Pt
873	7.4	Sm	888	10.3	Bx	852	15.2	Bg	011272			822	5.5	H	Z Cep		
874	7.5	Ht	902	9.3	B	855	15.2	Bg	894	8.4	Ch	824	5.8	H	021281		
875	7.4	En	904	9.1	L	861[	14.7	Bg	905	9.0	Pt	827	5.5	H	905	12.1	Pt
877	7.5	Bl	904	9.1	Sg	871	14.7	Bg	908	8.8	Bx	830	5.7	H	910	12.2	Rh
880	7.8	Kd	905	9.0	Pt	875	14.3	Bg	908	8.8	Kz	847	5.7	H	914	12.2	Rh
881	7.6	Sm	906	10.0	Jo	879	13.8	Bg	908	9.2	Eb	848	5.9	H	915	13.2	B
881	7.8	Ht	906	9.9	Cu	905	12.7	Bi	913	9.0	Rh	860	5.7	H	916	13.1	Ie
886	8.1	Kd	907	10.3	Kz	917	12.3	B	914	8.9	Rh	861	5.6	H	o Cet		
901	8.4	Kd	907	10.0	Eb	X Scl			914	9.3	Ie	874	5.4	H	*021403*		
903	8.4	Kd	908	9.6	Eb	*004435*			919	9 0	Gg	875	5.8	H	787	3.8	Lg
905	8.5	Pt	908	9.6	Kz	852[	13.6	Bl	922	9.0	B	880	5.9	H	787	4.0	Bc
X And			908	9.5	Bx	876[	13.6	Bl	922	9.5	Lv	884	5.7	H	789	3.7	Bc
001046			912	9.2	Bx	RR And			926	9.3	Lv	885	5.8	H	792	3.5	Lg
852	12.3	Bg	914	8.8	Ie	004533			U Psc			888	5.8	H	792	3.8	Ku
855	12.3	Bg	914	8.8	Jo	852	14.8	Bg	011712			898	5.4	H	800	3.3	Bc
860	12.8	Bg	924	9.1	Kz	855	15.1	Bg	905	12.4	Pt	899	5.7	H	805	3.2	Bc
861	12.7	Bg	924	9.5	Eb	861[	14.8	Bg	R Scl			904	5.4	H	805	3.2	Ku
867	12.9	Bg	924	9.3	Bx	871[	14.8	Bg	*012233a*			906	5.8	H	805	3.2	Lg
870	13.0	Bf	R And			875	15.3	Bg	825	7.9	Kd	909	5.9	H	806	3.2	Lg
875	13.0	Bg	001838			879	15.4	Bg	828	8.0	Kd	910	5.8	H	806	3.2	Bc
879	13.0	Bg	908[	12.4	Cu	— Cas			843	7.9	Kd	911	5.9	H	806	3.2	Ku
881	13.1	Bg	S Tuc			004746b			872	7.8	Kd	U Per			808	3.2	Ku
905	13.9	Bi	*001862*			905	10.8	Pt	884	6.0	Ae	015254			816	3.3	Ku
906[	12.5	Cu	863	11.3	Sm	916	10.3	Ie	901	7.8	Kd	888	10.1	Bx	816	3.2	Bc
914	14.2	Rh	863	10.7	Bl	W Cas			908	7.8	Kd	889	9.9	Hu	816	3.2	Lg
916	14.4	Rh	873	12.3	Sm	004958			911	7.7	Kd	905	10.0	Pt	818	3.3	Kd
T Cet			876	12.5	Bl	905	10.9	Pt	R Psc			914	10.0	B	819	3.4	Kd
001620			881	12.7	Sm	923	11.2	B	012502			S Ari			820	3.6	Kd
818	6.0	Kd	S Cet			U Tuc			852	12.3	Bg	015912			825	3.4	Kd
825	5.7	Kd	*001909*			*005475*			857	12.1	Bf	915[	14.0	B	827	3.6	Kd
828	5.9	Kd	886[	11.2	Ch	853	9.8	En	861	11.9	Bg	R Ari			828	3.8	Kd
843	6.0	Kd	906	14.2	L	863	9.5	Sm	867	11.7	Bg	021024			829	3.8	Kd
845	6.1	Kd	T Phe			863	10.1	Bl	870	11.4	Bg	883	8.7	Ch	829	3.6	Ku
853	6.2	Kd	*002546*			870	9.9	Bl	875	11.0	Bg	904	10.2	Wk	829	3.6	Lg
859	5.9	Kd	852[	13.6	Bl	873	10.3	Sm	880	10.8	Bg	905	10.0	Bi	832	3.8	Kd
872	5.9	Kd	853[	13.2	Sm	875	9.9	En	884	10.0	Gs	905	10.1	Pt	833	3.9	Lg
878	5.8	Kd	873[	13.0	Sm	877	10.1	Bl	886	9.7	Ch	909	10.2	Lv	833	3.8	Bc

VARIABLE STAR OBSERVATIONS RECEIVED DURING FEBRUARY, 1927—Continued.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
o CET	R CET	R HOR	W TAU	R DOR	S PIC
021403	*022000*	*025050*	042215	*043562*	*050848*
833 3.8 Ku	916 10.5 Ya	873 5.8 Sm	883 9.9 Mj	881 5.8 Ht	880[12.2 En
834 3.9 Ku	RR PER	874 5.1 Ht	884 10.0 Gs	R CAE	881[12.9 Sm
843 4.2 Kd	022150	875 5.9 En	889 8.5 Hu	*043738*	R AUR
846 4.3 Kd	864[13.5 Gu	877 5.0 Bl	905 9.6 Pt	852[12.0 Bl	050953
847 4.2 Kd	R HOR	880 6.1 En	906 9.5 Jo	853[12.0 Sm	905 11.1 Pt
848 4.3 Kd	*022426*	881 5.6 Ht	907 8.8 Cu	859[12.0 Ht	906 11.0 Cu
851 4.2 Kd	863 8.4 Bl	T HOR	914 9.3 Jo	874[12.0 Ht	908 12.0 Kz
852 4.3 Kd	870 8.5 Bl	*025751*	914 9.7 B	876[12.0 Bl	908 11.6 Eb
853 4.4 Kd	877 8.6 Bl	850 11.3 Bl	S TAU	881[12.0 Ht	914 11.0 Ie
853 4.4 En	U CET	863 11.9 Bl	042309	R PIC	922 11.2 Lv
853 4.6 Sm	*022813*	873 12.2 Sm	852 15.2 Bg	*044349*	926 11.7 Lv
854 4.5 Kd	886 11.0 Ch	876 12.3 Bl	857[14.8 Bg	852 9.4 Bl	T PIC
858 4.5 Kd	905 11.7 Pt	U ARI	861[14.8 Bg	863 9.8 Bl	*051247*
859 4.5 Kd	915 10.4 B	030514	872[14.8 Bg	870 10.0 Bl	852 8.2 Bl
860 4.8 Sm	RR CEP	852 14.6 Bg	876 15.3 Bg	876 9.7 Bl	853 8.7 En
861 5.0 Kd	022980	861 14.8 Bg	880 15.5 Bg	V TAU	859 8.8 Ht
871 5.4 Kd	905 13.0 Pt	871 14.8 Bg	907[13.0 Cu	044617	862 8.8 Sm
872 5.6 Sm	910 13.1 Rh	876 14.8 Bg	915[13.0 B	905 9.5 Pt	863 8.9 Bl
872 5.0 Ch	914 12.9 Rh	880 14.8 Bg	T CAM	907 10.0 Cu	863 9.2 Ht
873 5.5 Kd	916 13.1 Ie	907[13.3 Cu	043065	910 9.8 Rh	870 9.1 Bl
875 5.0 En	R TRI	X CET	904 13.9 L	914 9.9 Rh	873 9.5 Sm
878 5.4 Gs	023133	*031401*	905 13.6 Pt	916 10.0 Ie	874 10.0 Ht
878 5.6 Kd	884 9.0 Gs	886 8.9 L	908[13.2 Cu	928 9.4 B	875 9.5 En
880 5.8 Kd	886 8.9 Ch	904 9.1 L	RX TAU	R ORI	877 9.8 Bl
880 5.6 En	905 8.1 Bi	905 8.9 Pt	043208	045307	880 9.8 En
881 5.4 Sm	905 7.7 Pt	907 9.1 Cu	906 9.9 Hl	907 11.1 Cu	881 10.3 Ht
884 5.9 Gs	906 8.0 Jo	910 9.5 Kz	907 9.8 Cu	928 11.6 B	881 10.6 Sm
885 5.9 Kd	909 7.8 Lv	910 9.8 Eb	909 9.9 Lv	R LEP	T COL
885 5.6 Ch	910 8.2 Kz	915 9.5 B	910 9.8 Rh	*045514*	*051533*
886 5.2 L	910 8.1 Eb	916 9.5 Ya	914 9.9 Rh	872 10.0 Cb	852 9.7 Bl
886 5.9 Kd	914 7.2 B	Y PER	914 10.1 B	886 8.5 L	853 10.1 En
889 5.7 Ch	916 7.6 Ie	032043	922 10.2 Lv	905 8.5 Pt	859 10.5 Ht
889 5.9 Hu	916 7.5 Ya	889 8.9 Hu	R RET	906 8.2 L	862 11.0 Sm
895 5.7 Ch	922 7.2 Lv	905 9.6 Pt	*043263*	908 8.5 Jo	863 10.7 Bl
899 6.1 Kd	924 6.8 Kz	905 10.8 Gb	850 13.5 Bl	908 9.5 Cu	870 10.9 Bl
901 6.2 Kd	924 6.6 Eb	907 10.2 Cu	857[12.2 Ht	917 8.3 Jo	872 11.4 Sm
902 6.2 Kd	T ARI	916 10.3 Ya	863[12.5 Bl	V ORI	874 11.4 Ht
903 6.3 Kd	024217	R PER	874 12.6 Ht	050003	876 11.4 En
904 6.0 L	889 9.4 Ae	032335	875 12.4 En	905 10.8 Pt	877 11.5 Bl
905 6.3 Pt	905 9.2 Ae	907 13.0	876 12.5 Bl	907 10.7 Cu	880 11.4 En
907 6.7 L	W PER	910 12.8 Rh	880 12.4 En	910 10.7 Rh	881 11.4 Ht
908 6.4 Kd	024356	914 12.8 Rh	881 12.4 Ht	913 10.8 Rh	881 11.9 Sm
909 6.0 Jo	883 9.1 Mj	915 12.3 B	X CAM	928 9.9 B	S AUR
910 5.9 Kz	888 9.1 Bx	T TAU	043274	T LEP	052034
910 6.5 Kd	889 8.9 Hu	041619	878 9.8 Gs	*050022*	868 9.8 Hl
910 6.1 Eb	905 8.8 Pt	907 10.4 Cu	905 11.9 Pt	852 9.8 Bl	887 9.9 Ch
911 6.5 Kd	908 9.0 Bx	R TAU	908 11.6 Cu	863 9.0 Bl	888 9.2 Sg
914 6.4 Jo	908 9.2 Ks	042209	R DOR	870 8.9 Bl	904 9.2 Sg
916 6.7 Ya	908 9.3 Cu	852 12.4 Lv	*043562*	877 8.8 Bl	905 9.0 Pt
S PER	908 9.3 Eb	857 12.4 Lv	850 5.2 Bl	905 9.3 Pt	905 10.2 Gu
021558	916 9.0 Ya	861 11.8 Lv	853 5.4 En	908 8.8 Cu	905 10.2 Hl
886 8.4 Ch	928 9.0 B	870 10.5 Lv	859 5.2 Ht	928 8.8 B	906 10.2 Hl
889 8.5 Hu	R HOR	876 10.4 Lv	863 5.2 Bl	S PIC	907 10.1 Cu
905 8.5 Pt	*025050*	880 10.0 Lv	865 5.2 Ht	*050848*	W AUR
928 8.9 B	850 5.5 Bl	905 9.5 Pt	870 5.2 Bl	852[13.4 Bl	052036
R CET	853 5.5 En	915 9.5 B	873 5.8 Sm	853[12.2 En	887[11.5 Ch
022000	862 5.1 Ht	916 9.8 Ie	874 5.5 Ht	862[12.4 Sm	905 12.5 Pt
886 8.0 Ch	863 5.0 Bl	W TAU	875 5.8 En	873[12.9 Sm	906 12.4 Cu
910 10.4 Kz	865 5.1 Ht	042215	877 5.2 Bl	875[12.2 En	
910 10.2 Eb	870 5.3 Bl	878 10.4 Gs	880 5.8 En	877[13.4 Bl	

VARIABLE STAR OBSERVATIONS RECEIVED DURING FEBRUARY, 1927—Continued.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
S ORI	RU AUR	RS TAU	Z AUR	S LYN	R CMI
052404	053337	054615b	055353	063558	070310
905 9.0 Pt	888 12.0 Sg	907 9.4 Cu	914 9.7 Pt	866 13.9 Hl	902 9.2 B
906 9.6 Cu	905 13.4 Pt	RU TAU	915 9.5 Pt	891 13.8 Gu	906 8.9 L
915 9.0 B	908[12.0 Eb	054615c	918 10.2 Pt	891 14.0 Hl	R VOL
929 9.0 B	U AUR	870 10.5 Bf	919 10.2 Pt	905 13.9 Hl	*070772*
T ORI	053531	876 10.4 Bg	920 10.2 Pt	X GEM	853[12.6 Sm
053005a	887 9.5 Ch	880 10.3 Bg	922 10.0 Pt	064030	859 12.6 Ht
886 10.0 L	905 9.9 Pt	907 11.0 Cu	923 9.8 Pt	916 13.5 Bn	872 12.6 Sm
887 10.0 L	906 10.5 Cu	914 11.3 Ie	924 9.9 Pt	919 13.0 B	874 12.6 Ht
889 10.5 Hu	914 10.7 Ie	R COL	928 9.7 Pt	W MON	880 12.6 En
890 10.2 L	928 10.5 B	*054629*	R OCT	*064707*	881 12.6 En
903 10.0 Pt	SU TAU	852[13.0 Bl	*055686*	905 10.3 Pt	RR MON
904 10.1 L	054319	853[12.0 En	852 12.2 Bl	Y MON	071201
905 10.0 Pt	872 9.8 Ch	859[12.4 Ht	873 11.6 Sm	065111	889 9.6 Ch
906 10.2 L	884 10.4 Ae	862[12.4 Sm	877 11.7 Bl	905 10.6 Pt	909 9.6 Lv
906 9.8 Hl	886 10.5 L	872[13.0 Sm	X AUR	909 10.6 Lv	912 9.6 Lg
906 9.7 Gu	891 10.3 L	874[12.4 Ht	060450	921 9.5 Bi	V GEM
906 10.1 Pt	894 9.8 Ch	876[12.4 En	872 9.8 Ch	X MON	071713
907 10.0 Pt	903 10.3 Pt	877 13.0 Bl	887 8.8 Ch	*065208*	902 12.1 B
907 10.2 L	905 10.1 Pt	880[12.4 En	905 8.7 Pt	886 8.2 L	905 11.9 Pt
907 10.0 Cu	906 10.4 Pt	881 13.0 Ht	916 8.5 Ie	889 8.2 Ch	S CMI
909 10.3 L	906 10.4 L	881[13.0 Sm	— GEM	906 8.5 L	072708
911 10.9 Pt	906 10.4 Cu	U ORI	060822	907 9.6 Ch	872 7.7 Ch
912 10.9 Pt	907 10.4 Pt	054920a	805 3.9 Ku	919 9.1 Cb	886 7.5 Ch
913 10.0 Pt	909 10.3 Lv	820 7.4 Kd	806 3.7 Ku	V CMI	886 7.2 L
914 10.0 Pt	910 10.2 Ae	825 8.0 Gb	816 3.8 Ku	070109	890 7.4 Ch
914 10.7 Ie	911 10.3 Pt	889 8.9 Hu	833 3.5 Ku	905 12.7 B	894 7.1 Ch
915 10.2 B	911 10.5 Cu	894 10.2 Ch	834 3.5 Ku	910 13.9 Rh	902 7.7 B
915 10.0 Pt	912 10.4 Pt	902 9.8 B	V AUR	913 13.6 Rh	905 7.3 Pt
918 10.5 Pt	913 10.5 Pt	905 10.1 Pt	061647	916 13.5 Rh	906 6.9 L
919 10.4 Pt	914 10.4 Pt	906 10.2 Ch	907 13.0 Cu	922 14.0 Rh	906 7.0 Jo
919 11.3 Cu	914 10.3 Ie	906 10.3 Cu	V MON	R GEM	906 7.4 Cb
920 10.4 Pt	914 10.5 Cu	908 10.6 Eb	*061702*	070122a	908 7.3 Jo
922 10.5 Pt	915 10.5 Pt	908 10.6 Kz	889 7.8 Ch	882 7.7 Ch	930 8.1 Al
923 10.3 Pt	916 10.4 Cu	909 10.6 Lv	905 7.9 Pt	905 7.4 Pt	T CMI
924 10.4 Pt	918 10.3 Pt	909 10.2 Al	913 8.6 Rh	906 7.9 Jo	072811
928 10.2 Pt	919 10.2 Pt	910 10.7 Kz	914 8.5 Rh	906 8.5 Cb	902 11.7 B
928 10.9 B	919 10.4 Cu	910 10.4 Eb	922 8.6 Rh	908 8.5 Eb	Z PUP
AN ORI	920 10.4 Pt	921 9.9 Bi	923 8.5 Rh	908 7.9 Kz	*072820b*
053005b	921 10.3 Bi	928 10.3 B	U LYN	908 7.8 Bx	884 10.9 Ae
907 11.5 Cu	922 10.3 Pt	UW ORI	063159	909 7.7 Al	908 11.9 Ae
919 11.6 Cu	S COL	054920b	908[14.2 Cu	910 7.8 Kz	910 12.0 Ae
S CAM	*054331*	906 10.1 Ch	R MON	910 8.5 Eb	S VOL
053068	852 12.5 Bl	906 10.9 Cu	063308	912 7.8 Cb	*073173*
904 10.5 Wk	853 12.2 En	909 10.8 Lv	905 10.8 Pt	914 8.7 Ie	852 12.5 Bl
905 10.9 Pt	859 11.9 Ht	921 10.3 Bi	908 11.0 Cu	919 8.0 B	863 12.5 Bl
908 10.6 Cu	862 11.8 Sm	V CAM	NOV. PIC	919 8.3 Cb	877 12.7 Bl
910 10.4 Wk	863 12.1 Bl	054974	*063462*	Z GEM	U CMI
915 9.7 Wk	872 11.4 Sm	910[15.0 Rh	853 6.3 En	070122b	073508
920 9.6 Wk	874 11.8 Ht	922[15.0 Rh	853 6.3 Sm	905 12.4 Pt	886 12.9 L
RR TAU	876 11.2 En	Z AUR	859 6.3 Ht	908 12.1 Kz	902 11.5 B
053326	877 11.1 Bl	055353	862 6.3 Sm	908 12.1 Eb	905 11.4 Pt
852 11.0 Bg	880 10.8 En	887 10.6 Ch	865 6.3 Ht	919 12.3 B	906 11.4 L
861 12.9 Bg	881 10.8 Ht	903 9.8 Pt	867 6.3 En	TW GEM	S GEM
872 13.2 Bg	881 11.3 Sm	905 9.9 Pt	872 6.3 Sm	070122c	073723
875 12.3 Bg	Z TAU	906 10.0 Pt	874 6.2 Ht	905 8.1 Pt	872 10.0 Ch
877 12.0 Bg	054615a	907 10.0 Pt	876 6.0 Fn	919 8.1 B	885 11.2 Ch
879 11.9 Bg	876 14.1 Bg	908 10.2 Cu	880 6.2 En	R CMI	887 11.5 Ch
880 12.4 Bg	880 14.0 Bg	911 9.5 Pt	881 6.2 Ht	070310	905 12.3 Pt
881 12.8 Bg	914 13.8 Ie	912 9.5 Pt	881 6.3 Sm	884 8.5 Gs	919 12.6 Cl
906 12.4 Cu		913 9.5 Pt		886 8.5 L	

VARIABLE STAR OBSERVATIONS RECEIVED DURING FEBRUARY, 1927—Continued.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
W PUP	S HYA	X HYA	V LEO	W HYA	R CRV
074241	084803	*093014*	095421	*104620*	*121418*
852 8.4 Bl	908 10.5 Kz	851 8.3 Bf	922 9.0 Rh	892 8.4 L	913 12.1 Pt
859 9.2 Ht	908 10.5 Eb	858 8.4 Bf	RV CAR	913 8.2 Pt	SS VIR
862 8.9 Sm	T HYA	866 8.7 Bf	*095563*	913 8.4 Ae	122001
863 9.0 Bl	*085008*	874 8.7 Bf	852[13.1 Bl	RS HYA	892 7.7 L
865 9.3 Ht	887 10.0 Ch	880 9.1 Bf	877[13.1 Bl	*104628*	T CNV
870 9.3 Bl	892 10.0 L	887 9.3 Ch	RY LEO	877[13.0 Bl	122532
873 9.4 Sm	905 9.2 Pt	905 10.1 Pt	095814	W LEO	913 12.1 Pt
874 9.6 Ht	906 9.1 L	917 10.4 B	891 8.8 Kl	104814	Y VIR
877 10.1 En	910 9.3 Rh	R LMI	913 9.1 Kl	851 14.7 Bf	*122803*
877 9.9 Bl	914 8.8 Rh	093934	916 9.2 Kl	858 14.7 Bf	851 9.2 Bf
880 10.1 En	916 8.8 Rh	905 11.6 Pt	917 9.2 Kl	911[15.0 Rh	858 9.4 Bf
881 10.6 Sm	917 8.7 B	908 11.7 Kz	S CAR	916 15.0 Rh	866 10.2 Bf
T GEM	922 8.5 Rh	908 11.3 Eb	*100661*	922 14.5 Rh	874 10.4 Bf
074323	T CNC	910 11.0 Wk	852 8.4 Bl	RS CAR	880 10.8 Bf
872 9.1 Ch	085120	915 10.8 Wk	859 8.0 Ht	*110361*	892 11.5 L
885 9.2 Ch	887 9.3 Ch	920 10.8 Wk	862 8.0 Sm	853[12.3 Sm	922 13.8 Rh
887 9.2 Ch	905 8.6 Pt	R LEO	863 7.2 Bl	873[12.3 Sm	U CEN
894 9.4 Ch	V UMA	094211	865 7.0 Ht	876[12.3 En	*122854*
905 10.1 Pt	090151	883 5.8 Ch	872 7.0 Sm	881[12.3 Sm	877[12.4 Bl
U PUP	917 9.7 B	887 5.7 Ch	874 6.8 Ht	S LEO	T UMA
075612	W CNC	899 5.9 Ch	876 7.0 En	110506	123160
887 10.4 Ch	090425	905 5.9 Pt	877 6.9 Bl	916 14.5 Rh	833 7.3 Ku
902 10.5 B	910 13.7 Rh	906 5.9 Cb	879 7.0 En	922 14.5 Rh	844 7.1 Ku
908 10.6 Ae	916 13.1 Rh	908 6.1 Eb	880 6.8 En	RY CAR	886 7.8 Kl
910 10.6 Ae	917 12.5 B	908 6.1 Jo	881 6.9 Sm	*111561*	889 8.3 Ch
910 11.3 Rh	922 12.8 Rh	908 5.9 Kz	881 6.9 Ht	852 12.9 Bl	891 8.4 Kl
914 11.4 Rh	RW CAR	911 6.6 Cb	Z CAR	863 12.8 Bl	893 8.2 Kl
922 11.5 Rh	*091868*	914 6.3 Jo	*101058*	877 11.8 Bl	904 8.7 Wk
R CNC	852 10.3 Bl	917 6.2 B	852 11.9 Bl	RS CEN	906 9.1 Jo
081112	863 9.9 Bl	924 6.2 Kz	853 11.6 Sm	*111661*	906 9.3 Cb
883 10.5 Ch	876 9.6 En	924 6.6 Jo	863 12.2 Bl	852 9.0 Bl	910 8.8 Wk
886 10.2 L	877 9.5 Bl	924 6.2 Eb	872 12.3 Sm	853 8.6 Sm	913 9.2 Kl
905 9.9 Pt	880 9.5 En	930 5.8 Al	876 12.3 En	863 8.0 Sm	913 9.5 Pt
906 10.1 L	Y VEL	936 6.2 Al	877 12.0 Bl	863 8.2 Bl	914 10.5 Jo
906 10.1 Cb	*092551*	X LEO	880 12.3 En	873 8.3 Sm	915 9.7 Wk
V CNC	852 9.9 Bl	094512	W VEL	877 8.6 Bl	916 9.4 Kl
081617	862 9.9 Sm	908[12.3 Cu	*101153*	881 8.6 Sm	918 9.7 Kl
887[11.9 Ch	863 10.0 Bl	916 12.0 Cu	852 8.7 Bl	X CEN	918 10.0 Gb
905 11.6 Pt	872 10.0 Sm	Y HYA	853 8.7 Sm	*114441*	919 10.0 Cd
RT HYA	877 10.1 Bl	*094622*	863 8.7 Sm	877 12.8 Bl	920 9.7 Wk
082405	877 10.1 En	905 6.3 Pt	863 8.4 Bl	W CEN	930 9.6 Al
905 7.8 Pt	880 10.4 En	Z VEL	873 8.5 Sm	*115058*	936 10.4 Al
913 7.7 Ae	881 9.9 Sm	*094953*	877 8.3 Bl	852 9.0 Bl	R VIR
R CHA	R CAR	852[12.8 Bl	881 8.5 Sm	863 9.1 Bl	123307
082476	*092962*	853[12.1 Sm	U HYA	877 9.3 Bl	892 11.5 L
852[12.6 Bl	852 8.7 Bl	859[12.8 Ht	*103212*	R COM	913 11.1 Pt
853[12.4 En	853 8.5 En	874[12.1 Sm	854 5.7 Kd	115919	RS UMA
872[12.4 Sm	859 9.1 Ht	874[12.8 Ht	861 5.7 Kd	916 13.8 Rh	123459
876[12.4 En	863 8.8 Sm	876[12.1 En	892 4.7 L	922 14.0 Rh	851 13.1 Bf
877[12.6 Bl	863 9.0 Bl	877 12.6 Bl	R UMA	T VIR	858 12.9 Bf
880[12.4 En	865 9.1 Ht	880 12.1 En	103769	*120005*	866 13.6 Bf
881[12.4 Sm	873 9.0 Sm	881[12.8 Ht	905 11.6 Pt	913 13.6 Pt	874 13.8 Bf
U CNC	874 9.3 Ht	881[12.8 Sm	906 12.1 Cb	922 13.0 Rh	880 14.0 Bf
083019	876 9.0 En	V LEO	914 12.2 Te	R CRV	906[13.2 Cb
914 13.6 Rh	877 9.2 Bl	095421	917 11.9 B	*121418*	913 14.0 Pt
916 13.3 Rh	879 9.5 En	889 12.0 Ch	917 12.0 Cd	851 13.4 Bf	S UMA
922 13.8 Rh	881 9.2 Sm	905 12.9 Pt	W HYA	858 13.7 Bg	123961
S HYA	881 9.4 Ht	910 10.1 Rh	*104620*	866 14.2 Bf	886 9.2 Kl
084803		916 9.3 Rh	877 8.8 Bl	874 14.7 Bf	889 8.7 Ch
905 10.5 Pt		917 9.2 B	889 9.6 Ch	892 13.7 L	889 8.3 Sg

VARIABLE STAR OBSERVATIONS RECEIVED DURING FEBRUARY, 1927—Continued.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
S UMA	T APS	S CRB	SX HER	S OCT	R SCT
123961	*134677*	151731	160325	*172486*	*184205*
891 9.0 Kl	877 10.8 Bl	913 8.0 Pt	903 8.3 L	876 12.3 Bl	792 5.6 Ku
892 8.4 L	RR VIR	923 7.6 Gb	904 8.0 Pt	881 12.0 Ht	799 5.6 Ku
893 9.0 Kl	*135908*	RS LIB	905 8.1 Pt	RU OPH	806 5.7 Ku
904 9.0 Wk	913 12.5 Pt	*151822*	913 8.3 Pt	172809	816 5.8 Ku
906 9.1 Jo	R CEN	903 9.1 L	922 8.5 Pt	913 11.6 Pt	818 5.7 Kd
906 7.9 Cb	*140959*	RU LIB	RU HER	W PAV	819 5.8 Kd
910 8.7 Wk	874 6.6 Ht	*152714*	160625	*174162*	821 5.7 Kd
913 8.0 Pt	877 7.1 Bl	903 13.0 L	903 13.0 L	854 10.9 En	824 5.7 Kd
913 8.8 Kl	881 6.8 Ht	S UMI	913 12.2 Pt	863 11.4 Bl	827 5.6 Kd
914 7.9 Jo	U UMI	153378	S SCO	876 12.2 Bl	829 5.9 Ku
915 8.6 Wk	141567	883 8.6 Mj	*161122b*	RY HER	830 5.9 Kd
916 8.8 Kl	913 9.1 Pt	913 8.8 Pt	913 11.0 Pt	175519	833 5.5 Ku
918 8.8 Kl	918 10.0 Gb	R CRB	W CRB	913 12.6 Pt	838 5.5 Kd
918 8.5 Gb	S BOO	154428	161138	V DRA	839 5.5 Kd
919 8.1 Cd	141954	818 6.2 Kd	913 9.1 Pt	175654	943 5.7 Kd
919 8.0 Sg	892 8.5 L	821 6.2 Kd	V OPH	913 12.6 Pt	845 5.6 Kd
920 8.6 Wk	913 8.0 Pt	824 6.3 Kd	*162112*	R PAV	846 5.6 Kd
930 8.0 Al	923 8.0 Gb	827 6.2 Kd	913 8.6 Pt	*180363*	847 5.7 Kd
936 8.4 L	V BOO	849 6.2 Kd	U HER	854 10.9 En	851 5.7 Kd
RU VIR	142539a	854 6.2 Kd	162119	T HER	353 5.8 Kd
124204	892 9.1 L	860 6.3 Kd	913 11.8 Pt	180531	358 5.9 Kd
913 12.9 Pt	913 8.0 Pt	899 6.2 Kd	SS HER	816 8.9 Ku	861 5.9 Kd
922 13.2 Rh	923 7.8 Gb	903 6.0 L	162807	833 8.0 Ku	903 5.3 L
U VIR	R CAM	904 6.0 Pt	903 11.4 L	837 7.9 Ku	910 5.3 Kd
124606	142584	905 6.1 Pt	913 10.0 Pt	887 9.4 L	NOV. AQL
913 8.6 Pt	918 10.2 Gb	907 6.1 Pt	W HER	913 13.0 Pt	184300
U OCT	R BOO	910 6.0 Kd	163137	W DRA	913 10.5 Pt
131283	143227	913 6.1 Pt	913 9.2 Pt	180565	S CRA
852 11.4 Bl	816 7.6 Ku	914 6.0 Cu	R DRA	913 12.7 Pt	*185437a*
859 11.8 Ht	833 7.6 Ku	916 6.0 Cu	163266	X DRA	851 12.0 Bl
863 11.1 Bl	913 11.0 Pt	922 6.1 Pt	904 9.3 Wk	180666	R CRA
873 10.5 Sm	U BOO	923 6.0 Bg	910 9.3 Wk	913 12.2 Pt	*185537a*
874 11.2 Ht	144918	X CRB	913 9.8 Pt	NOV. OPH	851 12.0 Bl
877 10.6 Bl	914 11.0 Ae	154536	915 9.6 Wk	180911	T CRA
881 10.8 Ht	Y LUP	913 9.3 Pt	920 10.1 Wk	913[12.0 Pt	*185537b*
V VIR	*145254*	R SER	S HER	TV HER	851[12.5 Bl
132202	877[12.8 Bl	154615	164715	181031	R AQL
922 12.7 Rh	S APS	913 7.1 Pt	913 7.6 Pt	887 10.0 L	190108
R HYA	*145971*	V CRB	RS SCO	RY OPH	816 6.8 Ku
132422	863 10.1 Bl	154639	*164844*	181103	833 8.0 Ku
892 7.8 L	877 10.4 Bl	913 9.0 Pt	850 7.2 Bl	913 8.7 Pt	913 10.2 Pt
913 8.9 Pt	RT LIB	RR LIB	SS OPH	W LYR	X LYR
S VIR	*150018*	*155018*	*165202*	181136	190926
132706	913 11.0 Pt	903 9.8 L	913 9.1 Pt	887 11.6 L	913 8.9 Pt
913 11.1 Pt	T LIB	904 9.9 L	R OPH	913 12.0 Pt	RS LYR
RV CEN	*150519*	906 11.3 L	*170215*	RV SGR	190933a
133155	913 12.0 Pt	907 11.3 L	913 8.0 Pt	*182133*	913 11.7 Pt
877 8.0 Bl	Y LIB	909 12.0 L	Z OPH	862 8.0 Bl	RU LYR
T CEN	*150605*	913 8.5 Pt	171401	SV HER	190941
133633	903 13.3 L	RZ SCO	913 9.4 Pt	182224	913 12.3 Pt
860 6.2 Kd	S LIB	*155823*	RS HER	903 10.2 L	U DRA
881 6.2 Ht	*151520*	913 9.3 Pt	171723	913 11.4 Pt	190967
R CVN	903 9.0 L	Z SCO	913 9.1 Pt	X OPH	913 11.5 Pt
134440	913 8.5 Pt	*160021*	S OCT	183308	RY SGR
913 10.2 Pt	S SER	903 10.9 L	*172486*	913 8.3 Pt	*191033*
T APS	151714	U SER	850 13.0 Bl	RV LYR	850 8.9 Bl
134677	903 12.9 L	160210	859 12.8 Ht	184134	852 9.0 Bl
852 12.2 Bl	913 12.5 Pt	913 9.2 Pt	873 12.4 Sm	913 13.8 Pt	854 9.2 En
863 11.8 Bl			874 12.0 Ht		856 9.3 Bl
873 11.7 Sm			876 12.1 En		857 9.5 Bl

VARIABLE STAR OBSERVATIONS RECEIVED DURING FEBRUARY, 1927—Continued.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
RY SGR	NOV. CYG	P CYG	S IND	W CYG	RT PEG
191033	195553	201437a	*204954*	213244	215934
862 9.6 Bl	907[12.2 Pt	847 5.0 H	876[13.5 Bl	871 6.6 Kd	888 11.3 Ae
863 9.8 Bl	912[12.2 Pt	848 5.0 H	R VUL	873 6.6 Kd	889 11.3 Ae
TY SGR	915[12.2 Pt	WX CYG	205923a	879 6.7 Kd	905 11.4 Pt
191124	Z CYG	201437b	905 12.4 Pt	882 6.1 Go	910 10.8 Ae
851 12.4 Bl	195849	872 10.6 Ch	V CAP	883 6.1 Go	RV PEG
SW SGR	882[11.1 Ch	882 10.6 Ch	*210124*	884 6.1 Go	220133a
191331	905 12.8 Pt	905 10.0 Pt	851[12.7 Bl	885 6.1 Go	905 12.0 Pt
851[12.9 Bl	S TEL	U CYG	X CAP	886 5.8 L	RZ PEG
TZ CYG	*195855*	201647	*210221*	886 6.7 Kd	220133b
191350	851 13.1 Bl	872 8.1 Ch	851[12.7 Bl	901 6.5 Kd	905 12.2 Pt
913 10.0 Pt	876[12.6 Bl	905 7.9 Pt	X CEP	902 6.2 Kd	Y PEG
U LYR	SY AQL	U MIC	210382	903 6.1 Kd	220613
191637	200212	*202240*	922[15 0 Rh	904 5.7 L	852 11.6 Bg
913 10.6 Pt	887 10.0 L	862 11.8 Bl	RS AQR	909 5.9 Kd	855 11.8 Bg
AF CYG	S CYG	876 12.5 Bl	*210504*	911 6.0 Kd	860 12.4 Bg
192745	200357	SZ CYG	886 13.3 L	S CEP	867 12.8 Bg
808 6.6 Lg	882[11.1 Ch	202946	T CEP	213678	875 13.2 Bg
TY CYG	S AQL	903 9.0 Pt	210868	905 8.4 Pt	880 14.1 Bg
192928	200715a	904 9.2 Pt	882 10.0 Ch	RU CYG	RS PEG
882[10.2 Ch	876 11.5 Pt	905 9.0 Pt	886 9.4 L	213753	220714
R CYG	R TEL	906 8.9 Pt	904 10.1 Wk	882 8.8 Ch	852 13.0 Bg
193449	*200747*	907 9.2 Pt	905 10.0 Pt	885 8.6 Pt	855 13.0 Bg
818 6.6 Gs	851[13.5 Bl	911 9.4 Pt	906 9.6 L	910 8.8 Wk	860 12.5 Bg
882 6.6 Ch	876[13.0 Bl	912 9.8 Pt	910 10.3 Wk	915 8.6 Wk	867 12.4 Bg
905 6.7 Pt	W CAP	913 9.6 Pt	915 10.3 Wk	920 8.6 Wk	875 12.2 Bg
T PAV	*200822*	914 9.6 Pt	920 10.3 Wk	RV CYG	880 11.9 Bg
193072	851[12.8 Bl	915 9.4 Pt	T CAP	213937	905 9.5 Pt
854 11 9 En	RS CYG	922 9.1 Pt	*211615*	905 6 6 Pt	T GRU
863[11.5 Sm	200938	923 9.5 Pt	851[12.7 Bl	μ CEP	*221038*
874 13.2 Ht	872 8.9 Ch	924 9.6 Pt	S MIC	213958	863 8.5 Sm
876 13.3 Bl	873 8.9 Ch	928 9.8 Pt	*212030*	847 4.3 H	872 8.7 Sm
881 13.2 Sm	882 9 0 Ch	ST CYG	862 10.9 Bl	848 3.9 H	881 8.5 Sm
881[13.2 Ht	883 9.0 Ch	202954	863 11.1 Sm	860 4.2 H	S GRU
RT CYG	886 8.0 L	905 13.5 Pt	872 11.8 Sm	861 4.2 H	*221948*
194048	894 9.0 Ch	V VUL	876 12.3 Bl	874 4.2 H	853 12.4 En
816 7.8 Ku	904 8.2 L	203226	Y CAP	875 4.2 H	863 12.2 Sm
833 7.8 Ku	905 8.4 Pt	905 8.7 Pt	*212814*	880 4.2 H	865 12.2 Ht
905 11.9 Pt	R DEL	R MIC	851[12.9 Bl	884 4.0 H	872 12.2 Sm
TU CYG	201008	*203429*	W CYG	885 4.1 H	874 12.5 Ht
194348	887 10.5 L	851 10.8 Bl	213244	892 4.2 H	875 12.2 En
882[11.2 Ch	RT CAP	862 10.1 Bl	799 6.3 Ku	893 4.0 H	879 12.2 En
X CYG	*201121*	876 9.3 Bl	806 6.0 Ku	898 4.2 H	RV PEG
194632	821 7.5 Kd	S DEL	816 6.3 Ku	899 4.1 H	222129
882 8.0 Ch	859 7.6 Kd	203816	818 6.6 Kd	904 4.2 H	922 11.4 Rh
886 7.6 L	SX CYG	905 12.0 Pt	821 6.7 Kd	906 4.1 H	S LAC
889 7.9 Ae	201130	V CYG	824 6.6 Kd	909 4.1 H	222439
904 7.5 L	905 13.7 Pt	203847	827 6.6 Kd	910 4.2 H	883 8.0 Ch
905 7.6 Pt	RT SGR	905 12.9 Pt	833 6.5 Ku	911 4.1 H	905 8.5 Pt
RR SGR	*201139*	W AQR	834 6.7 Ku	RR PEG	R IND
194929	851 12.5 Bl	*204104*	836 6.1 Go	214024	*222867*
862 10.8 Bl	862 11.9 Bl	886 14.2 L	840 6.1 Go	905 13 1 Pt	851[13 5 Bl
RU SGR	876 11.0 Bl	U CAP	840 6.7 Kd	R GRU	876 12.8 Bl
195142	P CYG	*204215*	843 6.8 Kd	*214247*	T TUC
854 8.2 En	201437a	851[13.1 Bl	844 6.1 Go	851 13.3 Bl	*223462*
862 7.2 Bl	820 5.3 H	RZ CYG	845 6.7 Kd	872[12.9 Sm	853 9.2 En
863 7.6 Sm	822 5.4 H	204846	846 6.1 Go	879[12.4 En	862 9.3 Ht
876 6.9 Bl	824 5.4 H	905 12.1 Pt	851 6.7 Kd	881 12.9 Ht	863 8.9 Sm
Nov. CYG	827 5.2 H	S IND	854 6.1 Go	V PEG	873 8.7 Sm
195553	830 5.3 H	*204954*	859 6.7 Kd	215605	874 8.6 Ht
905[12.2 Pt	835 5.3 H	851[13.5 Bl	861 6.1 Go	905 9.9 Pt	875 3.7 En

VARIABLE STAR OBSERVATIONS RECEIVED DURING FEBRUARY, 1927—Continued.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
T TUC	V CAS	V PHE	ST AND	Z CAS	R TUC
223462	230759	*232746*	233335	233956	*235265*
880 8.7 En	905 7.8 Pt	853 10.8 Sm	885 10.2 Ch	916 13.3 Rh	880 10.8 En
881 8.1 Ht	915 8.0 B	853 10.8 En	905 10.2 Pt	RR CAS	881 11 8 Sm
881 8.2 Sm	W PEG	862 10.3 Ht	911 10.7 Lg	235053	R CAS
R LAC	231425	863 10.0 Sm	914 10.8 Lg	902 10.8 Bn	235350
223841	792 8.5 Ku	865 10.1 Ht	915 10.6 Lg	914 10.7 Pt	816 9.5 Ku
922 14.5 Rh	799 8.4 Ku	873 9.5 Sm	918 10.7 Lg	914 10.8 Bn	923 11.9 B
225914	806 8.8 Ku	874 9.5 Ht	921 10.1 B	921 11.0 B	Z PEG
RW PEG	816 9.2 Ku	875 9.5 En	925 11.0 Lg	V CET	235525
855 10.4 Bg	833 9.2 Ku	880 9.1 En	R AQR	*235209*	905 12.1 Pt
861 10.4 Bg	883 9.6 Ch	881 9.5 Ht	*233815*	851[13.0 Bl	916 12.7 Ic
867 10.6 Bg	891 10.4 Kl	881 9.2 Sm	872 8.7 Ch	876[12.8 Bl	SV AND
875 10.7 Bg	893 10.7 Kl	Z AND	883 8.8 Ch	R TUC	235939
880 10.6 Bg	913 11.0 Kl	232848	905 9.3 Pt	*235265*	905 11.0 Pt
905 11.8 Pt	916 11.4 Kl	883 9.3 Mj	907 9.1 Cd	853 10.2 En	910 11.1 Cl
R PEG	918 11.4 Kl	885 8.8 Ch	917 9.1 Cd	863 9.8 Sm	914 11.5 Ie
230110	S PEG	905 9.5 Pt		875 10.8 En	921 11.8 B
905 12.1 Pt	231508	922 9.2 Rh		873 10.8 Sm	
915 10.5 Lg	883 10.7 Ch				
916 11.0 Cd	905 11.6 Pt				

RAPIDLY VARYING IRREGULAR VARIABLES.

Star J.D.	Est.Obs.	J.D.	Est.Obs.	Star J.D.	Est.Obs.	J.D.	Est.Obs.
005840 RX ANDROMEDAE—				074922 U GEMINORUM—Continued			
4903.5	[11.7 Pt	4914.5	11.6 Pt	4905.7	10.2 Pt	4912.5	[13.3 Pt
4905.5	[12.4 Pt	4915.5	13.1 Pt	4906.3	10.1 L	4913.6	13.3 Pt
4906.5	[12.4 Pt	4918.7	[11.7 Pt	4906.5	10.6 Pt	4913.7	14.0 Rh
4907.5	[11.7 Pt	4922.5	[11.7 Pt	4906.6	10.3 Ae	4914.7	13.9 Rh
4911.5	10.8 Pt	4924.5	10.9 Pt	4907.3	10.6 L	4914.7	14.0 Cu
4912.5	11.1 Pt	4923.5	11.0 Pt	4907.5	10.6 Pt	4915.7	[13.9 B
4913.6	11.4 Pt	4928.5	11.0 Pt	4907.5	11.2 Cd	4916.6	[13.7 Ie
060547 SS AURIGAE—				4907.7	11.2 Cu	4916.7	14.0 Rh
4861.1	[15.1 Bg	4904.3	14.3 L	4908.6	11.6 Ae	4916.7	13.9 Cu
4870.2	10.5 Bf	4905.6	[12.6 Pt	4908.6	12.0 B	4917.6	[13.7 B
4871.1	10.8 Bg	4906.3	[14.5 L	4910.6	14.0 B	4918.7	[12.4 Pt
4871.1	10.8 Bf	4907.3	[13.9 L	4910.9	13.8 Rh	4919.5	13.9 Cd
4872.1	10.8 Bg	4910.8	15.0 Rh	4911.7	[13.7 Cu	4922.7	13.9 Rh
4872.0	10.9 Ch	4911.5	[12.6 Pt	213843 SS CYGNI—			
4872.1	10.9 Bf	4912.5	[12.6 Pt	4872.0	11.7 Ch	4906.5	11.5 Pt
4874.1	11.1 Bf	4913.8	14.6 Rh	4873 0	11.8 Ch	4906.5	11.1 Ae
4875.1	11.4 Bg	4914.7	14.5 Rh	4882.1	11.9 Ch	4907.5	11.7 Pt
4875.5	11.4 Bf	4915.5	[12.6 Pt	4882.2	12.2 L	4910.5	11.5 Cl
4876.1	12.3 Bg	4916.6	14.4 Rh	4883.1	11.8 Ch	4911.5	11.5 Pt
4876 2	12.2 Bf	4916.7	14.7 Cu	4884.5	11.8 Ae	4912.5	11.6 Pt
4877.1	12.7 Bg	4918.7	[12.6 Pt	4885.1	11.8 Ch	4913.3	11.5 Kl
4877.2	12.6 Bg	4919.7	14.8 Cu	4886.1	11.8 Ch	4913.9	11.7 Pt
4878.1	14.3 Bg	4920.7	[12.6 Pt	4886.2	12.1 L	4914.5	11.7 Pt
4879.2	14.8 Bg	4921.6	[13.3 Bi	4887.2	12.0 L	4914.5	11.6 Ie
4880.1	15.3 Bg	4922.7	14.5 Rh	4888.5	11.8 Ae	4915.5	11.7 Pt
4881.1	15.1 Bg	4923.8	14.5 Rh	4888.5	11.2 Bx	4916.3	11.1 Kl
4890.3	[14.0 L	4924.5	[12.4 Pt	4888.7	11.8 Sg	4916.5	11.6 Ie
4892.6	[14.5 L	4925.6	[12.0 Lg	4890.3	11.8 L	4918.3	11.4 Kl
4903.7	[13.3 L	4928.5	[12.6 Pt	4891.2	11.8 L	4919.5	11.6 Cd
074922 U GEMINORUM—				4891.2	11.0 Kl	4922.5	11.7 Pt
4884.2	[12.3 Ch	4890.3	14.0 L	4893.2	11.0 Kl	4922.5	11.3 Rh
4885.1	[12.3 Ch	4902.6	9.6 B	4894.1	11.1 Ch	4923.5	11.7 Pt
4886.3	[13.3 L	4905.5	9.1 Pt	4895.0	9.6 Ch	4924.5	11.7 Pt
4887.3	[13.3 L	4903 6	9.9 L	4899.0	8.7 Ch	4924 5	11.4 Cl
4888.6	[13.7 Ae	4904.3	9.9 L	4903.5	9.6 Pt	4928.5	11.9 Pt
4889.2	[12.3 Ch	4905.7	10.1 Ae	4905.5	11.1 Pt		

Total observations, 1743; Total variables, 337; Total observers, 43. "Hl"; Messrs. Houghton, "Ht"; Hunter, "Hu"; Iedema, "Ie"; Jones, "Jo"; Kanda, "Kd"; Kohl, "Kl"; Kukarkin, "Ku"; Kurtz, "Kz"; Lacchini, "L"; Lazarevsky, "Lz"; Leavenworth, "Lv"; Logan, "Lg"; Miyajima, "Mj"; Peltier, "Pt"; Recht, "Rh"; Skaggs, "Sg"; Smith, "Sm"; Watkins, "Wk"; and Yalden, "Ya".

LEON CAMPBELL, Recording Secretary.

March 7, 1927.

GENERAL NOTES.

Professor Frank Schlesinger has recently been awarded the Valz prize for 1926 by the Paris Academy of Sciences, especially for his work on stellar parallax.

Dr. Frank H. Loud, professor of Mathematics and Astronomy in Colorado College from 1877 to 1907, died after a brief illness at St. Petersburg, Florida, on March 2. Dr. Loud was in his seventy-sixth year.

Dr. H. A. Lorentz, professor of physics at the University of Leiden, Holland, will address the Franklin Institute on March 31, his subject being "How does an Atom radiate Light?" (*Science*, March 25, 1927.)

Professor Samuel G. Barton, of the department of astronomy at the University of Pennsylvania, gave a lecture on "The Earth's Motions and their Consequences" at the Brooklyn Institute of Arts and Sciences on March 11. (*Science*, March 18, 1927.)

M. Baillaud, on January 1, retired from the directorship of the Paris Observatory at the age of seventy-eight. The astrophysical Observatory at Meudon near Paris has now been combined with the Paris Observatory, and M. Deslandres, director of the former, is now in charge of both institutions.

Professor John George Hagen, director of the Vatican Observatory and formerly of Georgetown University, recently passed his eightieth birthday. In recognition of the occasion Pope Pius personally presented him with a specially cast gold medal. (*Science*, March 25, 1927.)

Professor Frank Schlesinger, director of the Yale Observatory, delivered the first in the series of George Darwin Lectures before the Royal Astronomical Society on March 11, on the subject "Astronomical Photography of Precision." (It was erroneously stated on page 187 of the March issue that this lecture was delivered on February 11.)

Carl Runge, the noted mathematician and physicist of Göttingen, died on January 3, 1927, at the age of seventy. In commemoration of his work, the issue of *Die Naturwissenschaften*, for March 11, is devoted largely to his accomplishments. One paper deals with a biographical sketch, another with his contributions in the field of mathematics, another with his work in spectroscopy, and another with the construction of physical apparatus according to his design.

Dr. R. A. Millikan, director of the Norman Bridge Laboratory of Physics of the California Institute of Technology, will deliver a course of twelve lectures before the graduate school of the Ohio State University on "Twentieth Century Discoveries in Physics." The dates and subjects of the individual lectures are as follows: April 11 at 8 P.M., "The Birth of Two Ideas"; April 12 at 4 P.M., "The Discovery of the Electron"; April 12 at 8 P.M., "Seeing the Invisible"; April 13 at 8 P.M., "Gulliver's Travels in Science"; April 14 at 4 P.M., "Light Darts"; April 14 at 8 P.M., "Stripped Atoms"; April 15 at 4 P.M., "The Birth of a Light Ray"; April 15 at 8 P.M., "Cosmic Rays"; April 16 at 11 A.M., "Relativity Inside an Atom"; April 18 at 4 P.M., "Pulling Electrons out of Metals"; April 18 at 8 P.M., "Isotopes and their Significance"; April 19 at 4 P.M., "Spectroscopic Prediction." (*Science*, March 18, 1927.)

Professor William F. Rigge.—News has just come of the death of Professor William F. Rigge on April 1. Professor Rigge was a teacher of astronomy and physics and director of the Observatory at Creighton University, Omaha, since 1896. During this time he was a frequent and valued contributor to these pages, and at present we have a manuscript by him to be published in the May issue. We personally feel the loss of an eminently capable and highly esteemed associate. A biography and an account of his many important contributions to his beloved science will be published in the near future.

A Survey of the Stars is the title of a paper by Dr. J. H. Jeans, published in *Nature* for March 12, 1927. This paper is from an address delivered to the Royal Astronomical Society on February 11, referring to the award of the Gold Medal of the Society to Professor Frank Schlesinger for his work on stellar parallax and astronomical photography. In this paper attention is directed to the great advancement made in the knowledge of stellar distances from the year 1901 to the year 1924. In 1901 Newcomb compiled a catalogue of stars of known parallaxes. The catalogue contains 72 stars, fifteen of which are "subject to more doubt than usual." In 1924 Schlesinger's "General Catalogue of Parallaxes" was issued containing 1870 stars whose parallaxes are given with a degree of accuracy suggested by the angle subtended by a pin-head at a distance of twenty miles. Although the progress has been rapid, nevertheless even at this rate 1000 years will be required to secure information concerning the distances of all the stars within a radius of 100 parsecs of the sun with the completeness with which the distances of stars within four parsecs of the sun are now known. One parsec represents a distance of 19,100,000 million miles, and the writer estimates that within a sphere of 100 times this distance as a radius there are about 281,250 stars. Speculating as to the time, past and future, the writer concludes as follows:

> "Just now we compared astronomy's past 3000 years of existence to the last tick of the clock in a dying century; we may with equal justice compare the 3000 years next to come to the first tick in a new century—such is the proportion it bears to the total time our present stars may be expected to last. Looked at on this scale there may be thought to be plenty of time for a really exhaustive survey of the universe, and past progress may be accounted amazingly rapid. In one tick of the clock astronomy has come to birth, has developed the most difficult and accurate technique known to science, and has surveyed the universe, accurately and completely to 4 parsecs, and sketchily and imperfectly beyond. The next tick of the clock should see the accurate survey extended to well beyond 100 parsecs, and astronomy has a whole century of life before it.

I fear there may be a fallacy involved in the adoption of this point of view; it is that we do not know how long the human race will endure. At the very longest estimate, man has only existed for a hundred ticks of our clock, civilized man for only two or three, so that our race and civilization would alike seem to be at the very beginning of their existence. Yet he would be a bold extrapolator who would assert with confidence that man is good for another three thousand million ticks of our clock on the ground that, if nothing unforeseen happens, the present stars will still be in existence at the end of that time. When we take a time-scale in terms of individual lives, we may still feel gratified at past progress, yet we cannot but feel awed by the magnitude of the task that remains."

The Southern Cross Observatory.—From time to time we have presented in these pages, various items of information concerning the Southern Cross Observatory at Miami, Florida. Through the courtesy of Mr. G. H. Lutz of Philadelphia, we are able at this time to present a photograph of the Observatory. Doubtless some surprise will be felt in looking at the accompanying photograph

THE SOUTHERN CROSS OBSERVATORY,
MIAMI, FLORIDA.

because the characteristic dome and building of the ordinary observatory are lacking. On the other hand, oftentimes an observatory is equipped with a single telescope. Here, however, there are five 5-inch telescopes and we are informed that two more are to be added in the near future. The people in the picture had come in the daytime to look at the spots on the sun.

The equipment of this observatory is the gift of S. Lynn Rhorer of Atlanta, and is operated without charge for the education and pleasure of the public. The greatest activity of the observatory takes place during the months from January to April. In addition to the use of the telescopes free lectures are provided and when objects of special interest are visible in the morning only, the observatory is opened two mornings each week. Early in March Professor Edwin B. Frost,

director of Yerkes Observatory, delivered two lectures under the auspices of this observatory. Through this agency great interest in astronomy has been awakened in Miami with the result that many private instruments are being secured and put into use. This interest doubtless will continue to grow as the climate there furnishes clear skies and excellent "seeing."

Grigg-Skjellerup Comet Rediscovered.—As this form was being put on the press, a telegram was received announcing the discovery of Comet Grigg-Skjellerup by Professor Van Biesbroeck. It is very fitting that the "vain efforts" mentioned by Professor Van Biesbroeck on page 229 should be so quickly changed into a "successful effort." The telegram reads as follows:

Grigg's periodic comet observed Van Biesbroeck March 31.0742; ascension $5^h\,50^m\,48^s.4$; declination $-3°\,7'\,30''$; magnitude 15. Shapley.

Junior Astronomer Examination. — United States Civil Service Commission under date, February 23, 1927, issued an announcement of a new type of examination to fill positions of junior astronomers in the Naval Observatory at Washington. Some of the changes in the new plan are (1). The Foreign language test has been omitted from the written part of the examination. (2). The subject of astronomy now includes questions on the branches of physics closely related to astronomy. The astronomy questions will be based on a first course in astronomy as given in colleges. (3). Applicants are now required to show in their applications, graduation from one of certain specified college courses, except that practical experience may be substituted for not exceeding two years of the formal education. (4). The entire examination may be taken in one day; formerly two days were required.

As difficulty has been experienced in securing eligibles for these positions, those interested are encouraged to try the examinations by greater possibility of securing an appointment. Further information may be secured from John T. Doyle, Secretary, U. S. Civil Service Commission, Washington, D. C.

Life in the Universe.—This is the heading for the three concluding paragraphs of an address by Professor J. H. Jeans on the subject "Recent Developments of Cosmical Physics." The address was delivered at University College, London, on November 9, 1926, and published in *Nature*, December 4, 1926. It was later printed in the *Journal of the Royal Astronomical Society of Canada* for January, 1927. The subject matter of the address is well described by the title in that it covers in a thorough way the most recent theories and conclusions of present day science. Although it requires considerable background to read intelligently the entire address, the concluding paragraphs touch the question which is of perennial interest not only to the scientist, but to the average person as well. This is our reason for re-printing them here.

> A general survey of the results obtained by cosmical physics has suggested that terrestrial laboratory physics is a mere tail-end of the general science of physics. The primary physical process of the universe is the conversion of matter into radiation, a process which did not come within our terrestrial purview at all until 1904. The primary matter of the universe consists of highly dissociated atoms, a state of matter which, again, was not contemplated until 1917. The primary radiation of the universe is not visible light, but short-wave radiation of a hardness which would have seemed incredible at the beginning of the present century. Indeed, our whole knowledge of the really fundamental physical conditions of the universe in which we live is a growth of the last quarter of a century.
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> The simple explanation of this situation is to be found in the fact that life, naturally enough, begins its exploration of Nature by studying

the conditions which immediately surround it; the study of the general conditions of the universe as a whole is a far more difficult task which life on this planet is only now approaching. Now the physical conditions under which life is possible form only a tiny fraction of the range of physical conditions which prevail in the universe as a whole. The very concept of life implies duration in time; there can be no life where the atoms change their make-up millions of times a second and no pair of atoms can ever become joined together. It also implies a certain mobility in space, and these two implications restrict life to the small range of physical conditions in which the liquid state is possible. Our survey of the universe has shown how small this range is in comparison with the range of the whole universe. Primeval matter must go on transforming itself into radiation for millions of millions of years to produce an infinitesimal amount of the inert ash on which life can exist. Even then, this residue of ash must not be too hot or too cold, or life will be impossible. It is difficult to imagine life of any high order except on planets warmed by a sun, and even after a star has lived its life of millions of millions of years, the chance, so far as we can calculate it, is still about a hundred thousand to one against its being a sun surrounded by planets. In every respect—space, time, physical conditions—life is limited to an almost inconceivably small corner of the universe.

What, then, is life? Is it the final climax towards which the whole creation moves, for which the millions of millions of years of transformation of matter in uninhabited stars and nebulae, and of waste radiation into desert space, have been only an incredibly extravagant preparation? Or is it a mere accidental and possibly quite unimportant by-product of natural processes, which have some other and more stupendous end in view? Or, to glance at a still more modest line of thought, is it of the nature of a disease which affects matter in its old age, when it has lost the high temperature and capacity for generating high-frequency radiation with which younger and more vigorous matter would at once destroy life? Or, throwing humility aside, is it the only reality, which creates, instead of being created by, the colossal masses of the stars and nebulae and the almost inconceivably long vistas of astronomical time? There are too many ways even to enumerate of interpreting the conclusions we have reached; I do not, however, think there is any one way of evading them.

BOOK REVIEW.

Norton's Star Atlas and Telescopic Handbook, Gall and Inglis, Publishers, Edinburgh, 10/6.

The fourth edition of this atlas has recently been issued. It represents a revision and extension of the former editions so as to include the recent developments in astrophysics. The contents of this atlas are so comprehensive that it furnishes one with information on practically every topic of astronomical study.

The tabulated values pertaining to the several planets, various conversion tables, list of Astronomical Societies and Publications, list of Astronomical Catalogues, list of Astronomical Symbols and their meanings, are a few of the interesting and useful items. Seventeen pages of definitions and notes on astronomical terms, including parsec, photovisual, absolute magnitude, enhanced lines, etc., are very helpful. A section on the care and use of the telescope, one of notes on the sun, planets, stars, a discussion of meteors and comets, a section on hints on observing, all together show how varied the suggestions it contains. After this descriptive material are found eighteen maps of various parts of the sky, the last two, showing the Galaxy, appearing in this edition for the first time.

This volume is highly recommended for all students and workers in astronomy, and deserves a place in every observatory library as a convenient reference work.